FEBRUARY 22, 1954

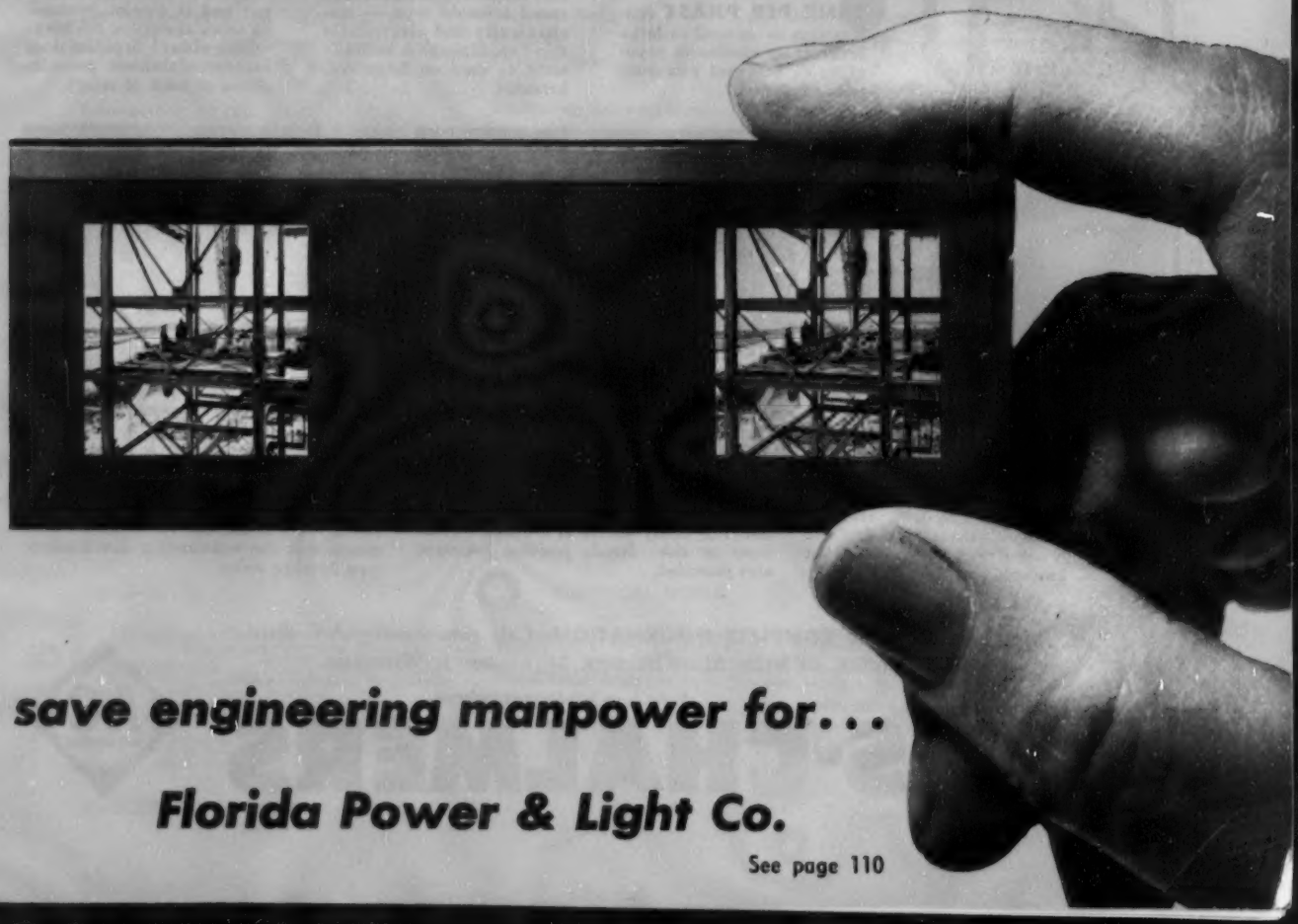
Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

3-D

Camera takes stereo color slides . . .



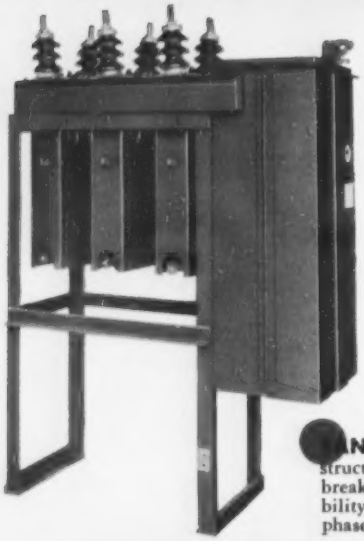
to save engineering manpower for . . .

Florida Power & Light Co.

See page 110

Get the breaker with these PLUS FEATURES

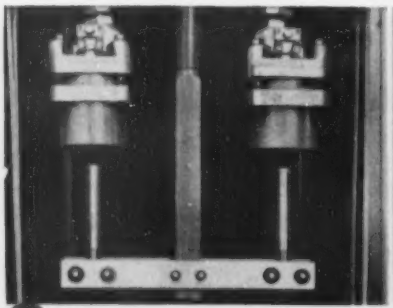
Here's increased operating convenience with high safety factor

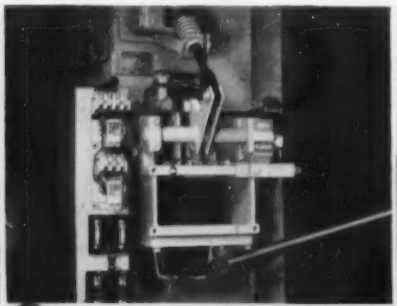


TANK PER PHASE construction — as used in large breakers — eliminates possibility of internal phase-to-phase flashover.

ACCESS FROM THREE SIDES. Side hinging of L-shaped doors allows side as well as front access to operator cabinet. Operator is high speed solenoid type — mechanically and electrically trip-free. Linkage is basically same as used on large A-C breakers.

NO FALSE OPERATION of relays. Operate the breaker — slam the door — or let the wind slam it and relays can't operate accidentally. Relay panel is in separate cabinet from operating mechanism and is 4-point mounted on shock absorbers. No hinge wiring either! Separate door in rear of cabinet provides access to back of relays.





TULIP AND BAYONET CONTACTS are self wiping, self aligning. Note also, double break per pole design and time-proved *Ruptor* interrupting device are used. Here again, Allis-Chalmers is using the same quality construction as is used on large A-C breakers.

VISIBILITY PLUS. Maintenance closing device is side operated. Man closing breaker can observe contacts and man working on them. In addition, external position indicator easily visible at a distance from front or side. Inside position indicator also provided.

NO BURIED LEADS. Simply remove three pins at bottom of fabricating wiring duct to expose bushing current transformer leads. No conduits, pipes, fittings to remove. This is just one more feature that makes this the outstanding distribution-type breaker today.

GET COMPLETE INFORMATION. Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4255

Ruptor is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Meet This Week's Writers

H. L. RORDEN R. S. GENS

Two Bonneville Power Administration aides have collaborated on an explanation on how protective practices cut the agency's transmission line costs. Their article is on page 101.

An Oregonian . . . One of the aides is Harold L. Rorden. A native of Oregon, he was graduated from Stanford University in 1925, earning his master's degree a year later. He served with General Electric Co and Ohio Brass Co before going to BPA in 1942 to do high voltage laboratory development work.

The other aide is Ralph S. Gens, who joined BPA in 1948. Gens, who received a B.S. degree in electrical engineering from Oregon State College in 1949, lives in Portland, Ore. He is married and has a 9 months' old daughter.

GE Engineers . . . H. M. Bankus and F. C. Van Wormer, who discuss the justification of aerial cable cost on page 98, are application engineers in the electrical utility engineering section of General Electric Co at Schenectady, N. Y.

Bankus, who hails from Portland, Ore., received an electrical engineering degree from Oregon State College in 1949. That same year he joined GE. Bankus, a resident of Schenectady, is married and has a two-year old son. His hobby—photography—consumes most of his spare time.

Van Wormer, who first served in 1931 on GE's testing training program, served for ten years with New York Power & Light Co, now part of Niagara Mohawk Power Corp, before returning to GE in 1945. He received from Rensselaer Polytechnic Institute an electrical engineering degree in 1930 and a master's in 1933.

Electrical World

Published for 80 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 141 No. 8 CONTENTS February 22, 1954

Features

Metering Aids Expansion ..... W. C. Morris, Jr. 96

Aerial Cable Cost Can Be Justified ..... F. C. Van Wormer and H. M. Bankus 98

Protective Practices Cut BPA Costs ..... H. L. Rorden and R. S. Gens 101

A1 Connector Requirements Set Up ..... I. Matthysse and H. P. Dupre 105

Navy Puts 4,500-kw Gas Turbine in Mobile Plant ..... M. A. Mayers, L. F. Deming, and J. K. Hubbard 108

Hundreds of Man-Hours Saved by 3-D Pix ..... Lowis Bowers 110

Departments

Editorials	87	Sales and Service	146
The Electrical Week	89	Industrial Applications	152
General News	90	New Equipment	168
Public Relations	114	Letters	182
Washington Comment	115	Catalogs and Bulletins	185
Technical Notes	115	Technical Literature	186
Statistics	116	News About People	188
Financial News	117	Manufacturers & Markets	194
How To	119	Meetings	197
Engineering Reference Sheet	130	Index of Advertisers	203

Book Reviews 205

RALPH H FLYNN, Publisher FISCHER BLACK, Editor DANIEL T BRAYMER, Managing Editor

A E KNOWLTON ..... Senior Associate Editor
FRANK R INNES ..... Associate Editor
LEONARD M OLMSTED ..... Associate Editor
ROBERT C BLATT ..... Associate Editor
KENNETH K KOST ..... Associate Editor
HERBERT R FRANKEL ..... Associate Editor
JOHN F WICKLEIN ..... Associate Editor
EDWARD ALLEN ..... Midwestern Editor
HOWARD S KNOWLTON ..... New England Editor
RUE M SHOOP ..... Middle Eastern Editor

FRANCIS KOVALCIK ..... Western Editor
JOSEPH MICHALAK ..... Assistant Editor
DAVID REA ..... Assistant Editor
JEANNE BERNHARDT ..... News Editor
IRIS ST CLAIR ..... Departmental Editor
ARY MOSSIMAN Manager of Market Research
ANN L ADAMS ..... Production Editor
W J WALLACE, JR ..... Assistant Art Director
G B BRYANT ..... Mgr Washington Bureau
JESSE MOCK ..... Washington Correspondent
DEXTER M KEEZER ..... Dir Economics Department

ROBERT P ULIN, RICHARD W EVERETT—Economics Department

WORLD NEWS BUREAU: Joseph K Van Denburg, Jr, Editor; London, Paris, Frankfurt, Tokyo, Sao Paulo, Mexico City, Manila. DOMESTIC NEWS SERVICE: Atlanta, Chicago, Cleveland, Detroit, San Francisco. Correspondents in 43 cities.

ADVERTISING STAFF: District Managers, E F Coffey, New York; N V Palmer, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; E S Chapin, Detroit; W H Meneilley, Chicago; J T Schaefer, St. Louis; Robert H Sidur, Atlanta; Carl W Dysinger, Los Angeles; John W Otterson, San Francisco; James Cash, Dallas

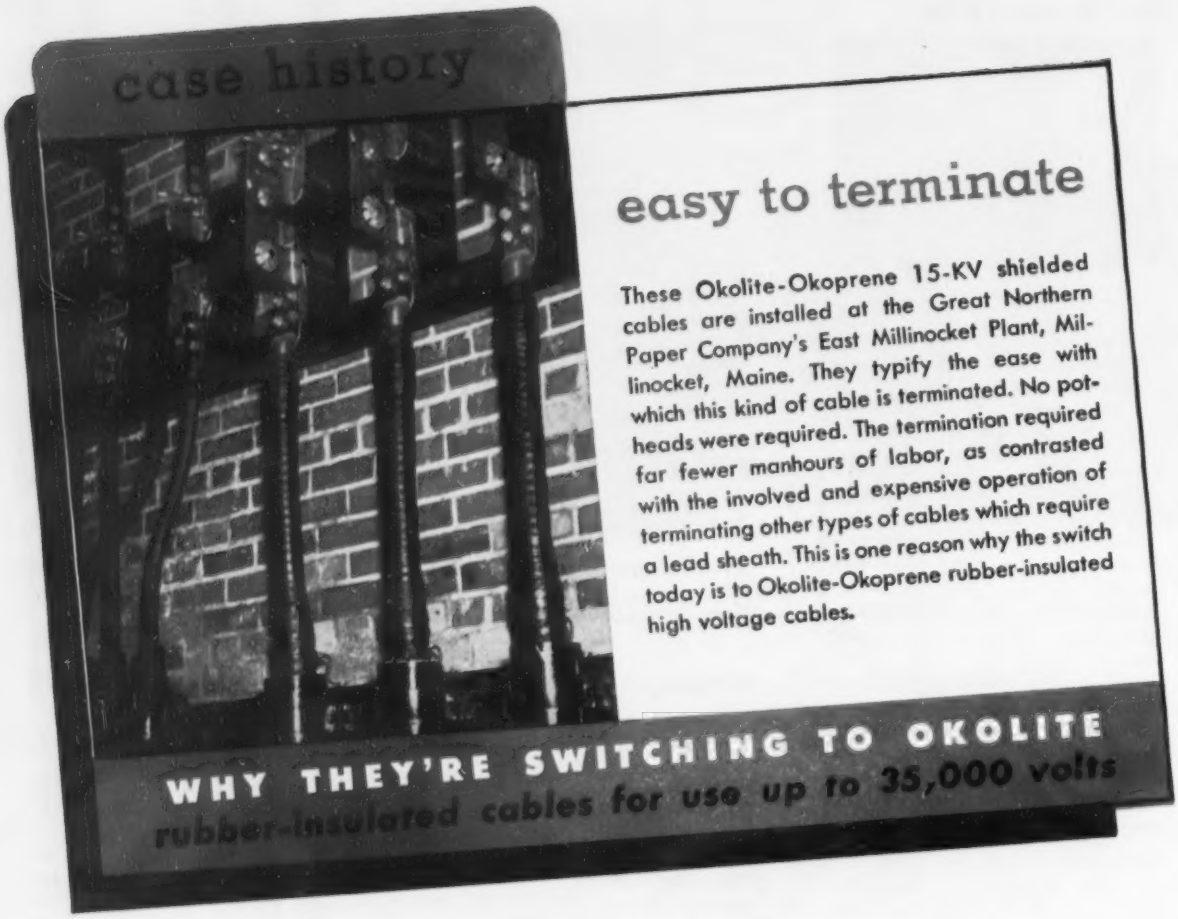
Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted from executive, supervisory and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and Possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in USA.

Copyright 1954 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.


case history
easy to terminate
These Okolite-Okoprene 15-KV shielded cables are installed at the Great Northern Paper Company's East Millinocket Plant, Millinocket, Maine. They typify the ease with which this kind of cable is terminated. No pothead was required. The termination required far fewer manhours of labor, as contrasted with the involved and expensive operation of terminating other types of cables which require a lead sheath. This is one reason why the switch today is to Okolite-Okoprene rubber-insulated high voltage cables.
WHY THEY'RE SWITCHING TO OKOLITE
rubber-insulated cables for use up to 35,000 volts

There is a distinct trend among industrials and public utilities toward Okolite rubber-insulated cables for high voltage use.

ADVANTAGES

1. **Lighter and easier handling.**
2. **Eliminates sheath corrosion and fatigue.**
3. **Simplifies splicing and terminating.**
4. **Moisture does not affect the insulation.**
5. **No oil migration at high temperatures or elevations.**
6. **Flexibility simplifies installation.**

APPLICATIONS

1. **Transmission and distribution circuits.**
2. **Generator and transformer leads.**
3. **Vertical risers and shaft cables.**
4. **Submarine power cables.**
5. **Portable substation cables and test leads.**
6. **X-ray cables.**

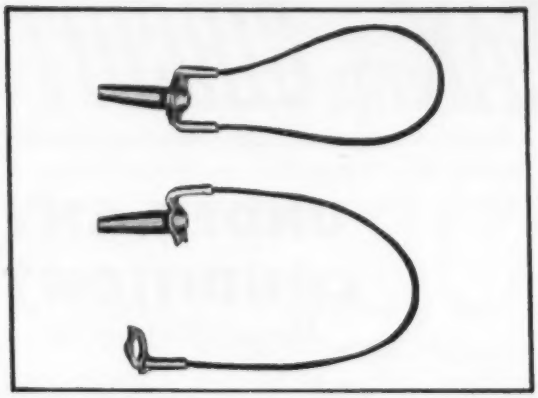
Send for this 128-page manual on rubber-insulated high voltage cable. It provides current carrying capacity tables, dimensional data, engineering information and installation procedures, complete instructions and detailed drawings for splices and terminations. Write for Bulletin EW-1075 on your letterhead to The Okonite Company, Passaic, New Jersey.

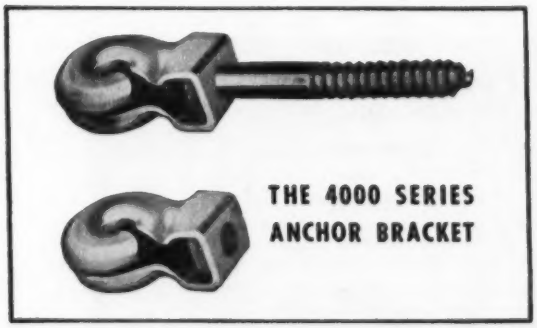
OKONITE OKONITE SINCE 1878 ***insulated cables***

1861

Electroline AUTOMATIC DEAD-END

for Neutral Supported Multiple Conductor Service-Drop Cable





THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

THE ELECTROLINE 3800 SERIES Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

ELECTROLINE 4000 ANCHOR BRACKET — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

WRITE FOR NEW BULLETINS FOR FULL INFORMATION

TALENT TO ORIGINATE E ABILITY TO PRODUCE

Electroline Company

4121 South La Salle Street • Chicago 9, Illinois

In Canada: POWERLITE DEVICES, LTD., TORONTO

How will you Sectionalize

DO YOU USE SWITCHES THAT CAN

BREAK the CIRCUIT

UNDER ANY CONDITION?

(Except Short Circuit)

NOW YOU CAN JUST PULL THE SWITCH

When emergency strikes . . . when an energized line is down . . . the S&C Alduti enables you to drop the load—all of it—at once!

No need to go through complicated unloading preliminaries . . . no need to open main breakers causing otherwise unnecessary interruptions . . . outages are held to a minimum . . . line repair can go forward immediately.

The S&C Load Interrupter drops the load with no lost time, NO external arc, and with safety to the operator.

HERE ARE SOME OF THE FEATURES YOU'LL FIND IN THE S&C LOAD INTERRUPTER

- Positive, "clean break" switching
- Safety to operators
- Interruption of all load currents and charging currents
- Independence from adverse wind conditions

Only one switch—the S&C Alduti—can give you all of these essential performance features . . . can break the circuit, and do it with NO external arc.

This is why the Alduti Load Interrupter has gained wide preference among power men . . . why leading utilities everywhere specify it for sectionalizing.

S&C

SPECIALISTS IN

your System?

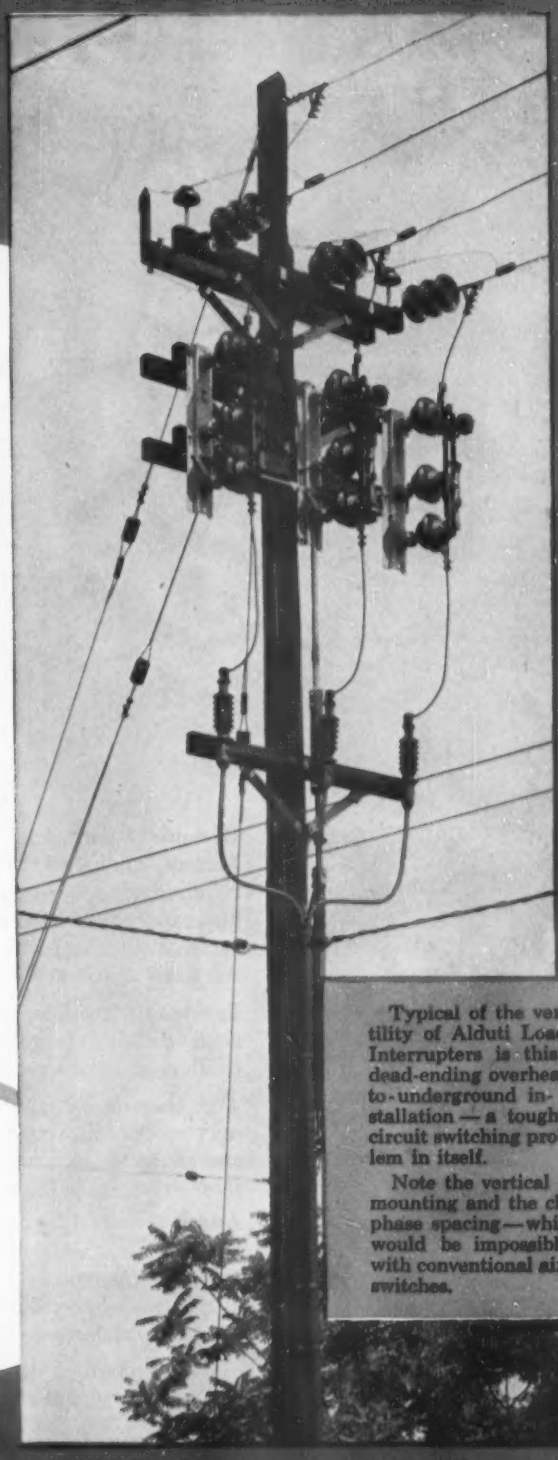
IF NOT, you are missing the kind of operating flexibility you get with the S&C Alduti Load Interrupter . . .

The Alduti Load Interrupter can be operated *any* time . . . instantly . . . without communicating down the line to find out whether load conditions permit switching . . . a very important advantage during storm and emergency conditions.

With the Alduti, switching operations can be carried out without sequencing with circuit breakers—an important advantage during storm or emergency.

And it can drop your *entire* load . . . individual loads never need to be removed as a preliminary.

Interested? Then write today for literature. It will give you new ideas on sectionalizing.



Typical of the versatility of Alduti Load Interrupters is this dead-ending overhead-to-underground installation — a tough circuit switching problem in itself.

Note the vertical mounting and the close phase spacing—which would be impossible with conventional air switches.

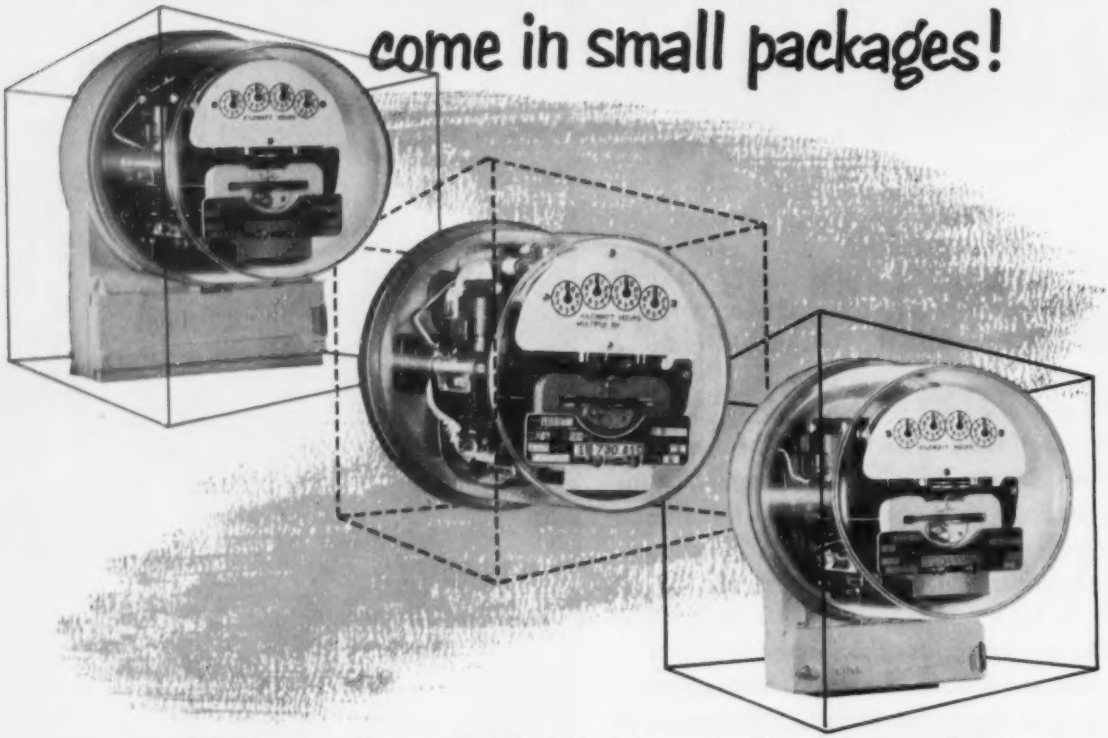
ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U.S.A.
formerly Schweitzer & Conrad, Inc.

IN CANADA, S&C ELECTRIC CANADA, LTD.
8 VANSCO ROAD, TORONTO 14, ONTARIO

HIGH-VOLTAGE CIRCUIT INTERRUPTION

All Sangamo Polyphase Meters come in small packages!



Because of their single disk construction, *all* Sangamo Polyphase Meters, whether 2, 2½, or 3 element, come in the smaller sizes required of modern power meters. This saves installation time and expense. For example, on change-overs to 4-wire network systems, the Sangamo LC-3 Element Meter will fit in exactly the same space as the delta 2 element meter which it replaces.

Besides the smaller size and lighter weight, the use of but a single disk also increases bearing life, lessens the effect from friction on light loads, and provides stability of calibration.

Too, there is the convenience of all adjustments, including the micrometer adjustments for full load, light load, inductive load, and element balance, being readily accessible—with just a screwdriver—enabling easy testing on the premises.

And if it should be necessary to install your polyphase meters in locations of extreme exposure to corrosive industrial or salt atmospheres, you can expect much longer meter life because of the special corrosion-resistant finishes with which all Sangamo Meters are treated.

For more detailed information on Sangamo Polyphase Meters ask your Sangamo Representative.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-IR

How THE NATION'S LEADING PIPELINES USE

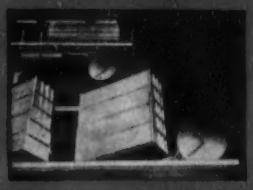
PHILCO *MICROWAVE*

Philco Microwave is being used daily by the Nation's leading pipeline companies. These pipeline companies have selected microwave because: (1) it is an economical, reliable and expandable communications system eliminating costly and vulnerable wire lines, and (2) it provides them with private, dependable communications over long distances, cutting maintenance costs to a minimum.

Pipelines stretching over hundreds of miles can be operated and controlled from a single point by microwave. Pressure, rate of flow and tank level readings can be recorded automatically and relayed to headquarters or various points along the route. Philco Microwave carries telephone, teletype, control and telemetering channels... *and offers complete tie-in with VHF two-way radio systems and existing wire line facilities.*

Shown here are two of the many Philco Microwave systems that provide the nation's leading pipelines with modern and efficient communications.

OTHER INDUSTRIES USING PHILCO MICROWAVE

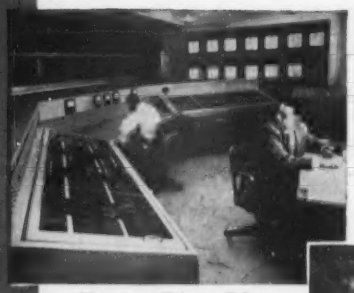


Communication companies use Philco Microwave for telephone, telegraph and television transmission. Reliability, economy and quality of transmission make Philco Microwave ideal for their use.

Philco Microwave is being used by leading railroads for telephone, telegraph and train dispatching. Microwave is a private system, saves costly wire installations and simplifies right-of-way problems.

Utilities rely on Philco Microwave for the control of power stations, dispatching of repair trucks and communication. Dependable channels, unaffected by adverse weather, are a necessity for utility use.

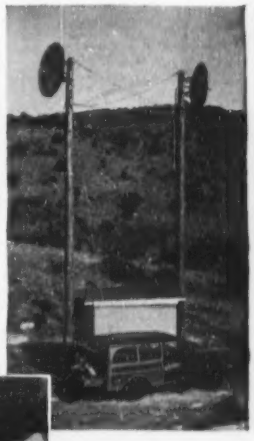
For complete details, write to Dept. EW today!



From this central console headquarters at Kansas City, Missouri, the entire Platte pipeline and communication system can be controlled and monitored.

Platte Pipe Line Company's microwave system is over 1000 miles long... to provide every communication and control facility: voice channels, remote supervisory control, continuous or selective telemetering, teletype, alarm signaling and VHF radio. This entire microwave system was surveyed, designed and installed by Philco.

Typical Philco Pipeline Installations



El Paso Natural Gas Company has 500 miles of Philco Microwave with an average distance of 50 miles between stations. This New Mexico to Arizona system consists of repeater and terminal stations, multiplexing equipment for system party line and VHF radio channels.

The longest microwave hop in the nation is this 81-mile El Paso hop from Mount Elden to Dilkon, Arizona ... typical of the utilization of terrain advantage by Philco.

PHILCO *Means Quality* the World Over

PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION PHILADELPHIA 44, PA.

There's no such thing as "ELKONITE® or equal"

Elkonite Contacts Combine...

- Good Conductivity
- Resistance to Sticking
- Resistance to Arc Erosion
- Impact Strength

...in a way that can't be matched!

For heavy duty circuit interrupting service Elkonite Contacts have no equal. They are made by an exclusive Mallory process that combines the desirable qualities of metals which cannot be alloyed. The high melting points of tungsten, molybdenum or their carbides are combined with the current-carrying ability of silver and copper through a unique impregnation process that is the result of 25 years of Mallory pioneering in the specialized field of contact materials.

It is not only the composition that makes Elkonite a superior contact material... it is the physical structure... the *way* the materials are combined.

The result is a contact material that has no equal in combining good conductivity, impact strength, resistance to arc erosion and sticking... qualities that mean top performance in heavy duty service.

When you specify Elkonite, the contacts in your products will last longer... give better performance. And Mallory has a complete family of contact materials that will meet all the requirements of circuit breakers and switch gear of any rating.

New Contact Catalog

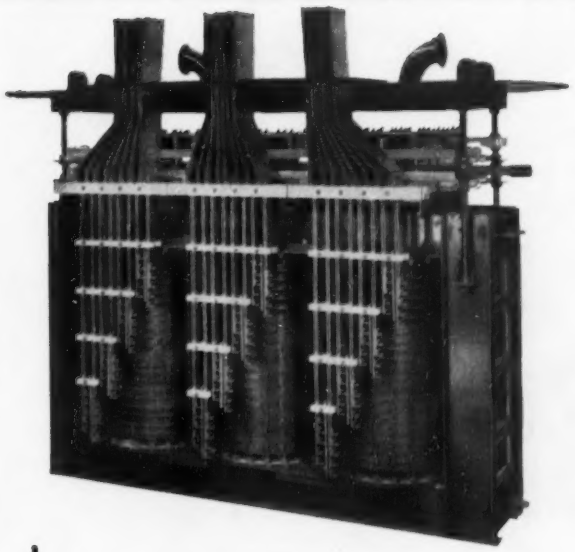
Write for your copy today. It includes a discussion of Mallory materials and facilities for producing contacts and contact assemblies for every service... as well as valuable technical and design data.

Expect More... Get More from **MALLORY**

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

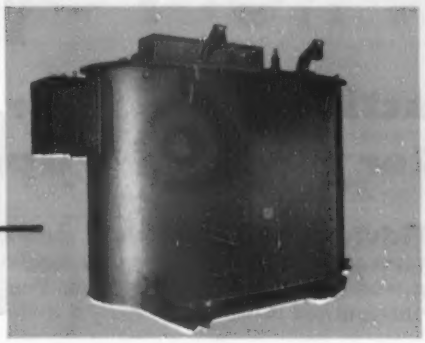
P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc. INDIANAPOLIS 6, INDIANA

100 kva...25,000 kva...or higher...



25,000 Kva Furnace Transformer, Low Voltage Side. 3 Phase, 60 Cycles, Water-cooled. High Voltage: 13800 volts. Low Voltage: 430 to 290 volts.

Pennsylvania can build a Furnace Transformer for any size electric furnace



External view of transformer. Compartment on left houses motor-operated tap changer.

The successful operation of Pennsylvania Furnace Transformers and their industry-wide acceptance indicate that Pennsylvania engineers fully understand the application of furnace transformers to electric furnaces.

For example, in 1936 Pennsylvania introduced a new type of helical winding in the low voltage coils of a 2500 Kva furnace transformer. Since then, the same principles of coil design have been incorporated into Pennsylvania furnace transformers totaling over 1¼ million Kva. In all the intervening years, there has *never* been a low voltage winding breakdown on any of these furnace transformers.

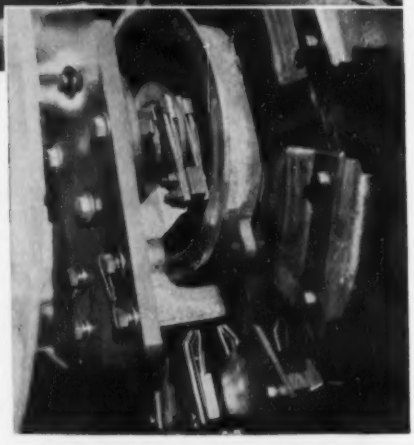
Because its engineering is basically and fundamentally correct, Pennsylvania can build furnace transformers for any size electric furnace now being manufactured or being contemplated for future construction.

PENNSYLVANIA TRANSFORMER COMPANY
A McGRAW ELECTRIC COMPANY DIVISION
CANONSBURG, PA. • Greater Pittsburgh District

Allis-Chalmers Gives You

17 YEARS' PROOF

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATORS

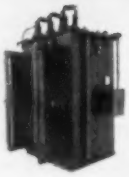


Practically No Wear After 1,240,000 Operations

Pictures above and at right show mechanism and contacts of an Allis-Chalmers power regulator that operated on a west coast utility for 17 years. You can see from these unretouched photos that nearly a million and a quarter operations resulted in practically no wear. This regulator is still in condition to provide many more years of satisfactory service.

You get operating records like this only from Allis-Chalmers. Twenty years of experience designing and building 5/8% step voltage regulators results in rugged construction and proved reliability. Laboratory tests, for example, show that the *Quick-Break* mechanism can withstand five million operations. The 17-year result shown above adds field proof to these laboratory tests.

Next time you consider regulation, for new or replacement installations, it will pay you to check the advantages of Allis-Chalmers regulators. For complete details on their design and construction see the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4243



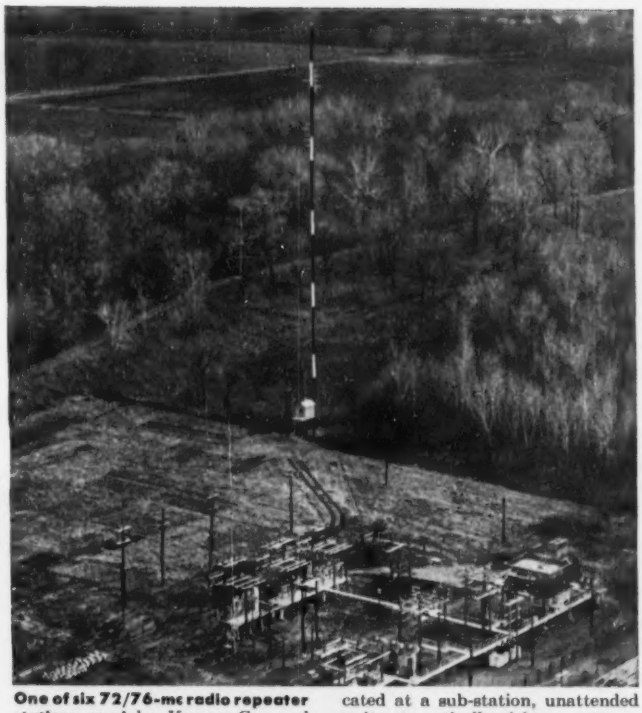
Three-Phase Power Regulator

Single-Phase Power Regulator

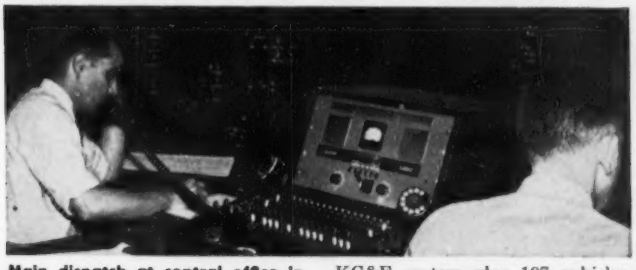
Single-Phase Distribution Regulator

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

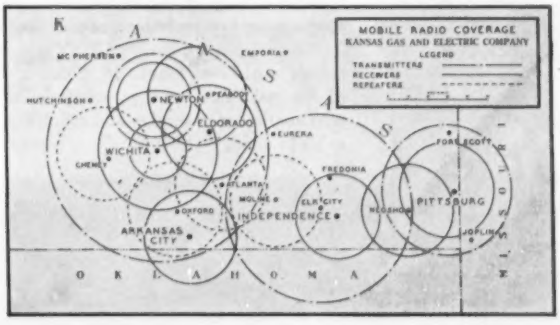


One of six 72/76-mc radio repeater stations used by Kansas Gas and Electric Co. to boost coverage. Located at a sub-station, unattended unit automatically picks up, retransmits traffic instantaneously



Main dispatch at central office in Wichita has instant communication with all operating points on the KG&E system plus 107 vehicles. Complete system diagram surrounds dispatcher and radio operator

107 RCA mobile radio units do many jobs—on line, relay and communication trucks, on signal-engineering and trouble cars, on agents' and line supervisors' cars. Spare units are stored at scattered points



RCA 2-Way Radio "breaks the ice" for Kansas Gas and Electric

"SEVERAL TIMES ICE STORMS have knocked down our telephone lines," says Mr. P. W. Mark, Communication Engineer for Kansas Gas and Electric Company. "Two-way radio was the only communication we had. It helped us trouble-shoot and make needed repairs in a hurry.

"Our system—which uses RCA *Fleetfone* equipment—was designed to function under the worst possible conditions," Mr. Mark reports. "With it we can rapidly get in touch with men in the field who are nearest the sources of trouble. It helps us sectionalize the line at fault. Our repair men can move directly from one job to the next. When crews need material, they can call and have it sent out immediately."

Kansas Gas and Electric uses its RCA 2-Way Radio system for many other functions where *time* is a factor. System operation, handling "hot work" permits, obtaining clearances on lines, meeting emergencies—are but a few of the many jobs it helps perform quickly and efficiently.

A series of 8 base stations, 6 repeater stations, and 2 control links makes up the Kansas Gas and Electric 2-way radio system. (See coverage map). Two of the base station transmitters are 250-watt, six are 60-watt. This combination gives the utility instant contact with 107 vehicles over the full area of its operations.

For day-to-day dependability—the kind of reliable communications you need when troubles develop—look into RCA 2-Way Radio for your next job. Our *free* literature will give you the advance information you need, and an RCA Communications Specialist will be glad to discuss long-range plans with you. *Mail the coupon—you incur no obligation.*

And remember, the RCA Service Company provides nation-wide service facilities.

Radio Corporation of America
Communications Equipment, Dept. B45
Building 15-1, Camden, New Jersey

Without obligation on my part, please send me

- ☐ Latest literature on RCA 2-Way Radio
- ☐ Brochure, "Electric Utility Microwave Systems"

Name_____ Title_____

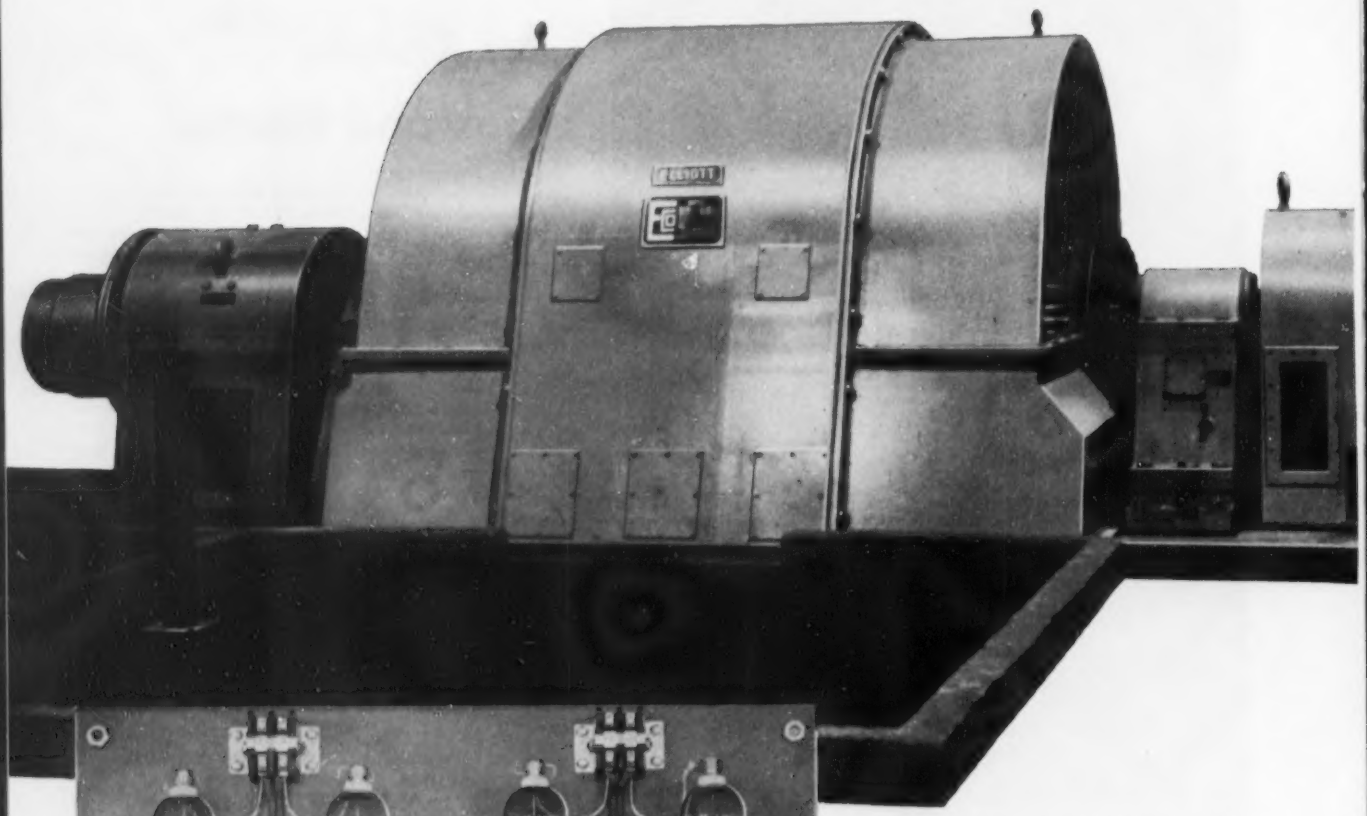
Company_____ Address_____

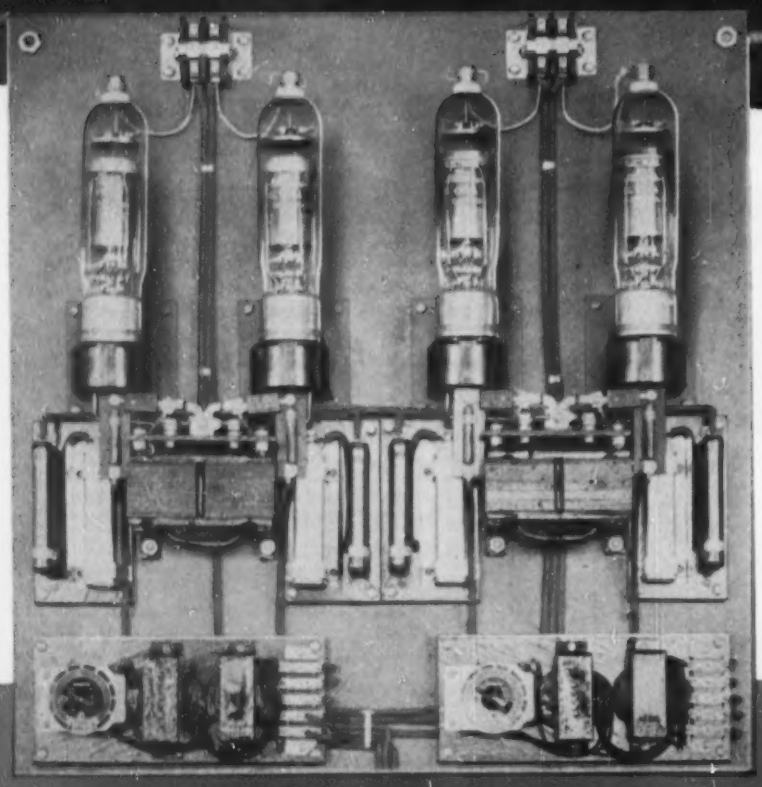
City_____ Zone_____ State_____

☐ Please have an RCA Communications Specialist get in touch with me.

RCA **RADIO CORPORATION of AMERICA**
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Smoothing out the rough





Shown above is the 20,000-kva, 900-rpm, 3-phase, 60-cycle, 13,200-volt air-cooled synchronous condenser installed at Owensboro, Kentucky, plant of Green River Steel Corporation. The direct-connected main and pilot exciters are self-cooled with filtered air inlets. The wound-rotor starting motor at the right end of the machine has a similar cooling system. Each bearing pedestal has an integral oil lift pump and oil circulating pump assembly, utilizing an oil-to-water heat exchanger. Cooling of the condenser itself is with an air-to-water heat exchanger mounted in a pit beneath the floor.

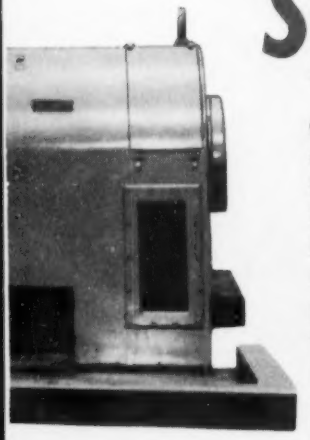
A high-speed voltage regulator of the electronic type was designed by Elliott Company to complement the low reactance condenser. Shown at left is a section of the regulator with grid-controlled, gas-filled tubes. All circuit components of the regulator were selected conservatively, with continuity of service and reliability of operation in mind.

STEAM TURBINES

MOTORS

GENERATORS

spots in electric furnace loads ...with an ELLIOTT Synchronous Condenser



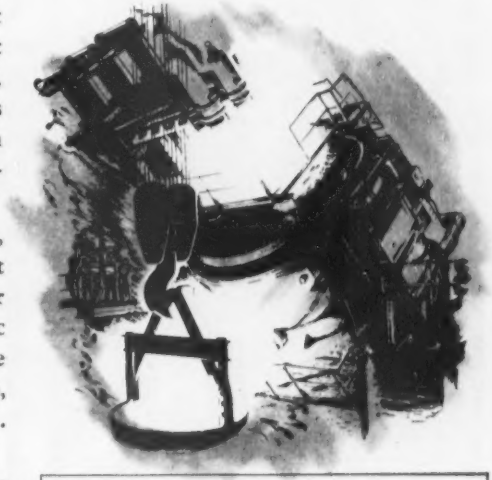
● Line current swings are violent and erratic during the meltdown period in an electric arc furnace. With a 60-ton furnace, for example, instantaneous current surges up to 2½ times full load are common. Such load fluctuation can result in a serious flicker problem for the supplying utility.

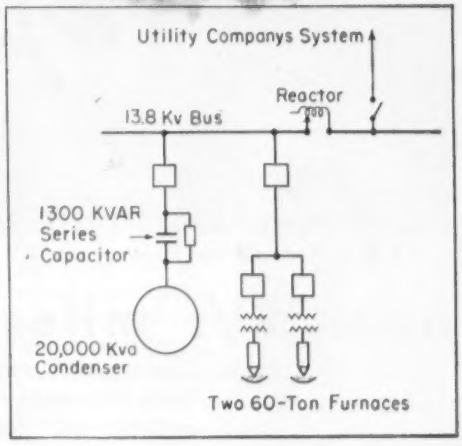
To avoid this, Green River Steel Corporation, Owensboro, Kentucky, has installed an Elliott 20,000-kva, air-cooled synchronous condenser in conjunction with their twin 60-ton electric arc furnaces. This condenser, which has the unusually low subtransient reactance of 21%, supplies leading KVAR . . . automatically . . . during surge periods.

A unique feature of the installation is the use of a capacitor in series with the synchronous condenser to provide maximum reactive output. Elliott-engineered control equipment insures full protection and instrumentation for the installation.

This simplified one-line diagram shows the arrangement of bus, capacitor, synchronous condenser, and electric furnaces employed by Green River Steel Corporation.

For complete details on Elliott synchronous condensers, air- or hydrogen-cooled, consult your Elliott representative or write Elliott Company, Ridgway, Pa.





Elliott FABRI-STEEL

ELLIOTT Company

R4-9

DEAERATING HEATERS

EJECTORS

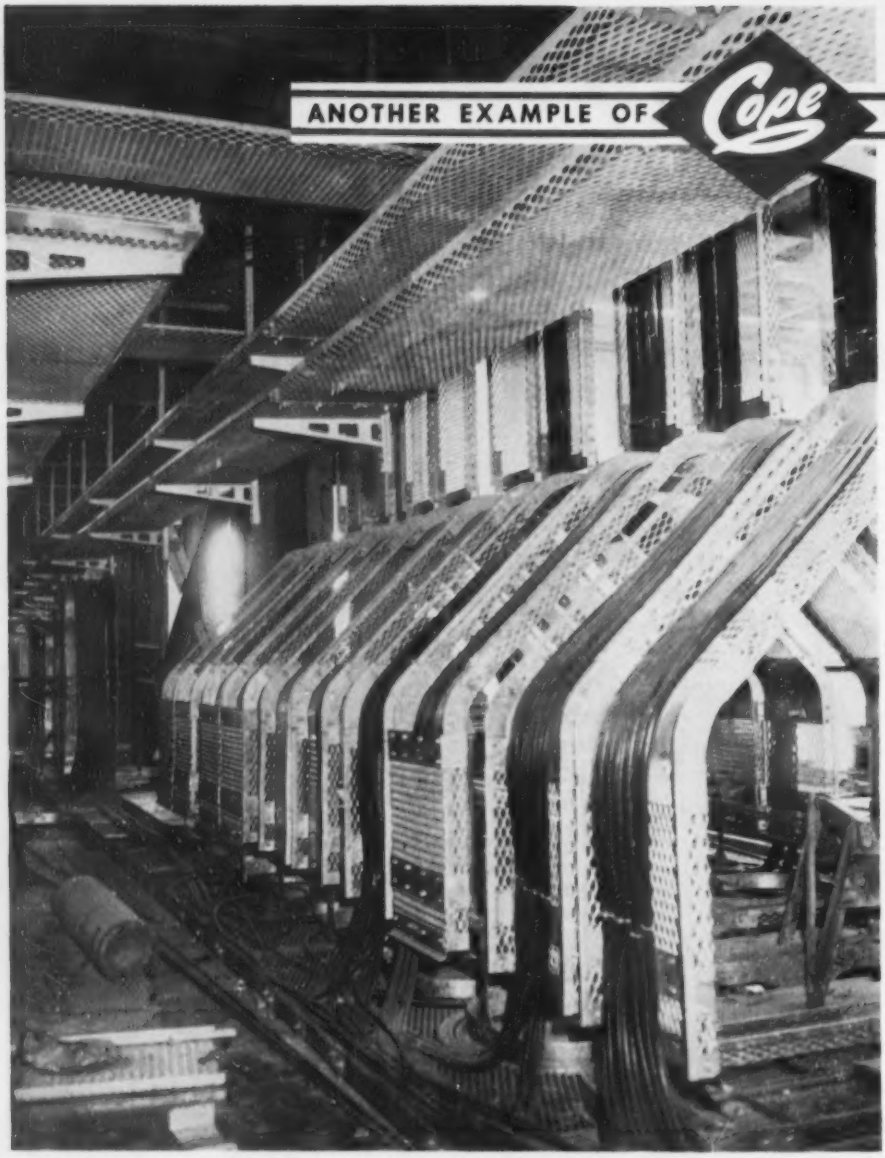
CONDENSERS

CENTRIFUGAL COMPRESSORS

TURBOCHARGERS

TUBE CLEANERS

STRAINERS



Ohio Edison Company, Niles Station • Hatzel & Buehler—Electrical Contractors

over 2½ miles of Cope Cable Trough

. . . has been installed in the Ohio Edison Company's new 212,000 kw. steam station at Niles, Ohio, to carry both auxiliary power and control circuits throughout this gigantic structure. All circuits are readily available for maintenance, and sufficient trough area remains for additional cables necessary for future expansion.

The simplification of design through the use of standard parts, plus the ease of installation and the low installed cost, make possible many savings which may be obtained through using COPE Cable Trough.

For further information, write today for Bulletin 2W.

You know Cope by these products

Cope

T. J. COPE, INC.

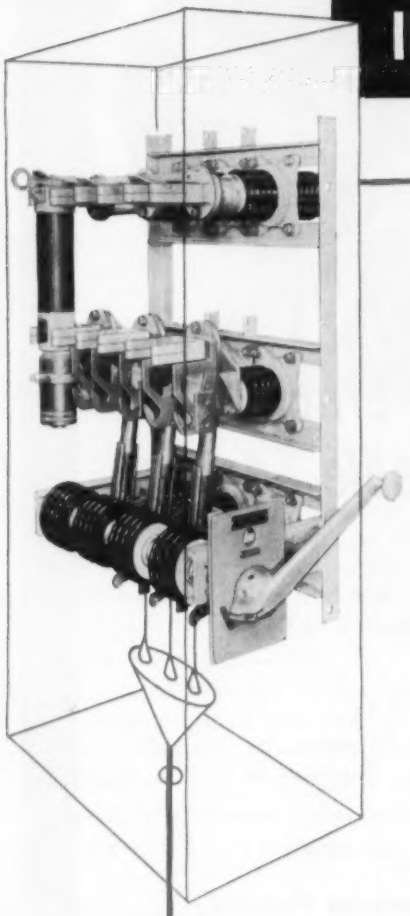
711 SOUTH 50th ST., PHILADELPHIA 43, PA.

Increase SAFETY FACTORS on important load centers

Check the Facts

1. Mounts anywhere—wall, transformer throat, etc.
2. Load interruption always assured.
3. Proper operating procedure guaranteed by sequencing device on operating handle.
4. Provision for key or solenoid type interlock.
5. Any desired fuse and switch arrangement possible.
6. Supplied with or without housing—door interlocks optional.

SAFE-DEPENDABLE R&IE INTERRUPTER SWITCHES



INTERRUPTING ABILITY and OPERATING LIFE

The interrupting ability and operating life of an air interrupting switch is a function of the magnitude of current and voltage, interrupted, the interval between operations and the constants of the circuit being interrupted. For these reasons, the interrupting rating of such a switch cannot be expressed adequately by a single value of amperes or KVA, as is the common practice for circuit breakers and fuses, but must be expressed as a curve or tabulation of operating life at various currents under specified test conditions. The values applicable under one set of conditions may vary widely under another set of conditions. Under the conditions specified by NEMA, plunger type R&IE interrupter switches have the interrupting ability and operating life shown here.

AMPERES INTERRUPTED	NUMBER OF OPERATIONS
25	500
50	225
100	100
200	45
400	20
600	12
1200	5

For complete details send for Bulletin 1360-A.

R&IE INTERRUPTER SWITCH EQUIPMENT

DIVISION OF I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

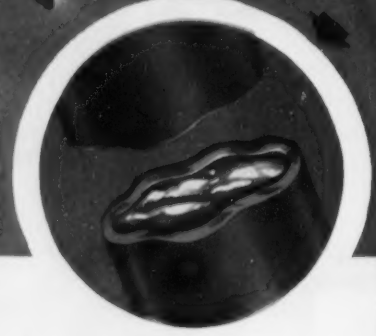
KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

BLACKBURN *Copper-Bonded* GROUND ROD



THESE 5 POINTS

Assure You of Permanent, Efficient Grounding and Quick Dependable Service

1. A hard-drawn, rigid steel core, for ease of driving.
2. Completely covered, including top and bottom, with a heavy, uniform coating of pure copper, molecularly bonded, to fully protect steel core.
3. Rolled finish produces hard, scar-resistant surface.
4. Stocked by leading wholesalers — backed up by a stable, dependable source, strategically located for quick shipments to all parts of the country.
5. Backed by Blackburn's reputation for quality and value.

Distributed on the West Coast by KORTICK Manufacturing Company

JASPER BLACKBURN CORPORATION

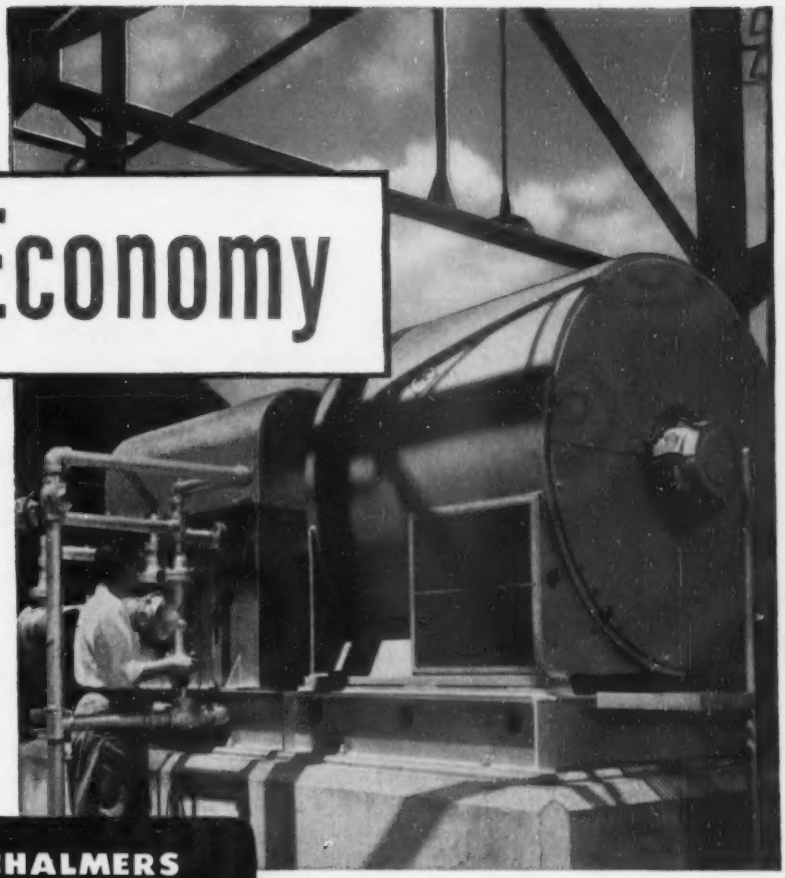
33 Madison St., St. Louis 8, Mo. • Phone CEntral 3007

3-Way Economy

OPEN SKY is all the roof they need

MAINTENANCE is cut to the minimum

RELIABILITY assures maximum availability



ALLIS-CHALMERS
Tube-Type
TEFC MOTORS

Induced-draft fan motor for A-C turbine-generator equipped installation at Georgia Power's Plant McManus is rated 900 hp, 2300 volts, 705 rpm.

WITH Allis-Chalmers *tube-type* totally-enclosed fan-cooled motors, you can cut auxiliary drive costs three ways. The opportunity for low installation cost through outdoor applications is only the beginning. Low maintenance and peak reliability both pay worth-while dividends throughout the long life of these motors.

These savings can be yours because the *tube-type* air-to-air heat exchanger design of Allis-Chalmers TEFC motors offers these advantages:

Complete enclosure protects stator core and other electrical parts from dirt and corrosion — indoors or out — under the most severe ambient conditions.

Self-cleaning action results from generous flow of outside air through smooth, straight, heat-exchanger cooling tubes.

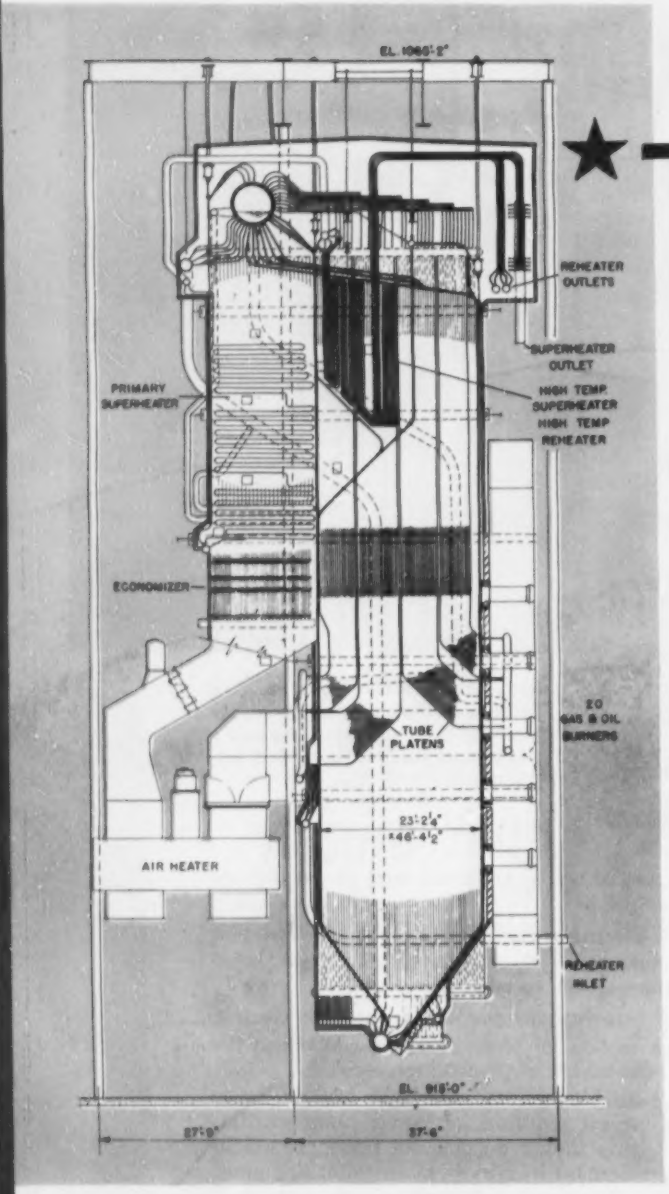
Full internal air circulation provides efficient, even cooling for long, trouble-free insulation life . . . and makes large ratings practical.

Available in sizes from 40 hp at 600 rpm to the largest required for power plant auxiliaries, this motor design has been proved in operation by hundreds of installations since 1946. For more information ask your A-C representative for Bulletins 51B7149 and 05B7150, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-4258

ALLIS-CHALMERS

As Los Angeles Grows

so grows its Kw. load



Two 1,200,000 lbs./hr. RILEY Reheat Units at Valley Steam Plant will Boost Total RILEY Generated Steam for City of Los Angeles to 6,225,000 lbs./hr.

The first two of Riley Steam Generators at Los Angeles' Harbor Steam Plant went on the line in 1943. These two units were designed for quick pick-up of load in event of hydro power failure. Then, in 1948 three more Riley units of 825,000 lbs./hr. were added.

But, in recent years phenomenal increases in population, numbers of homes and industrial establishments in Los Angeles have made imperative the addition of still more power facilities.

The Department of Water and Power has ordered two Riley 1,200,000 lbs./hr., 2075 psig Reheat Units for its new Valley Steam Plant. When installed, the total volume of steam produced by complete Riley Steam Generating Units in the Department of Water and Power Plants will be 6,225,000 pounds per hour.

Here is another instance of repeat orders for Riley and a good indication that you can rely on Riley to meet any power generating need.

ENGINEERING DATA

Two complete Riley Steam Generating Units 1,200,000 lbs./hr. capacity at 1850 psig.
2075 psig design
1000°F. Steam
1000°F Reheat
Furnace Width 46' 4½"
Furnace depth 23' 2¼"
Furnace volume 88,400 cu. ft.
Heat Release per cu. ft. of furnace volume 18,400 BTU.
Heat Release per sq. ft. of furnace envelope 84,000 BTU.
Total Efficiency 86.4%

TRADE MARK Rx REGISTERED

RILEY
STOKER CORPORATION

WORCESTER, MASS.
Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle

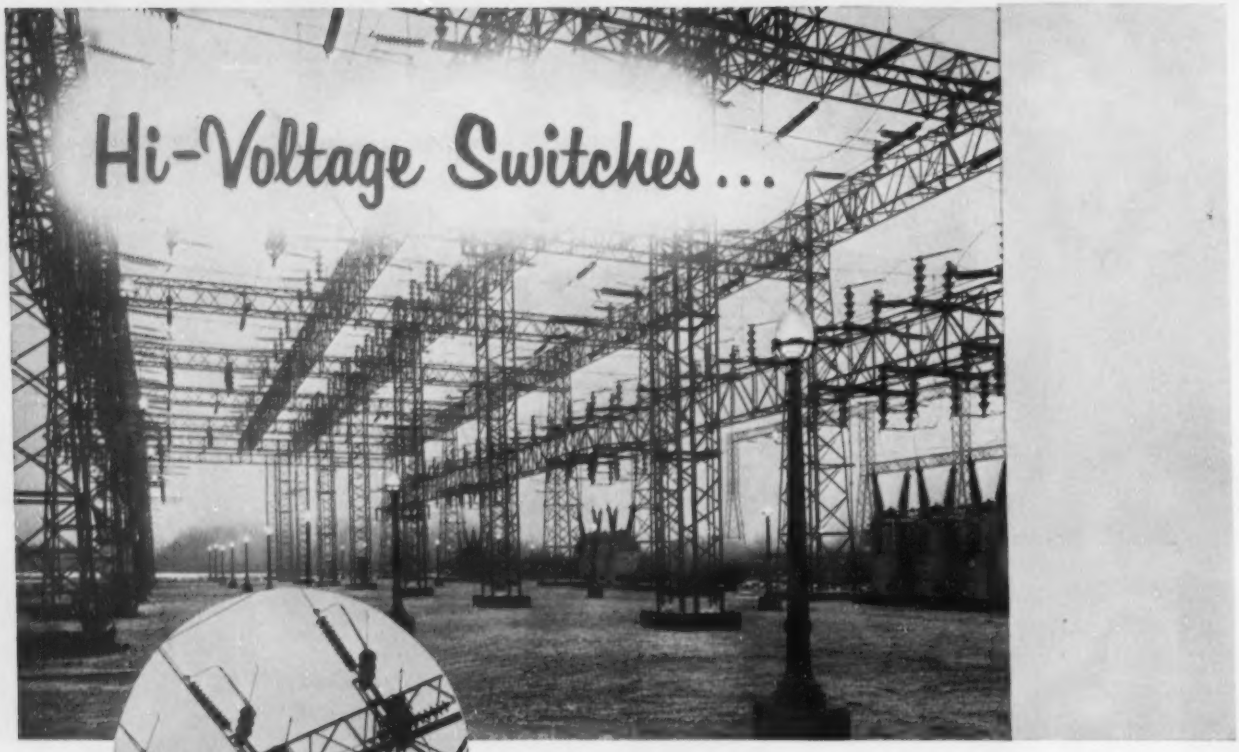
COMPLETE STEAM GENERATING UNITS

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · ECONOMIZERS
WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

Above—Three complete Riley steam generating units. Gas and Oil Fired. 825,000 lbs./hr. capacity. 1200 psig, 900°F., Efficiency 87.7%. This design has a Riley Single Header Hopper Bottom in event of future use of pulverized coal.

Below—Two complete Riley steam generating units. Gas and Oil Fired. 675,000 lbs./hr. capacity. 1091 psig, 915°F., Efficiency 86.1%.

If you, too, are considering steam-generating additions to your power facilities, it will pay you to learn first what Riley can do for you.



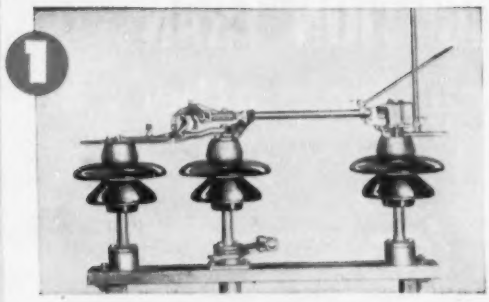
when they were installed 33 years ago . . . had the exclusive "IN-OUT-UP" action. Today's Hi-Voltage Switches have the same basic operating principle.

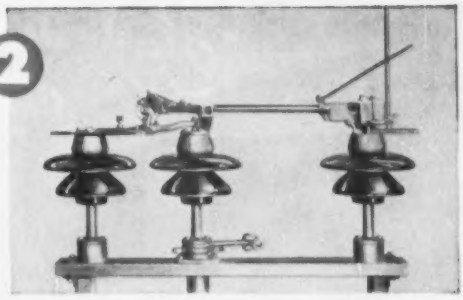
When a basic design is RIGHT, there is no need for periodic changes to keep it "in Mode". Consider a fundamental design, such as a *wheel.* You can change the bearings in it to lengthen life. A steel rim can be replaced by a rubber tire to assure quieter operation. But you cannot improve the *fundamental* design.

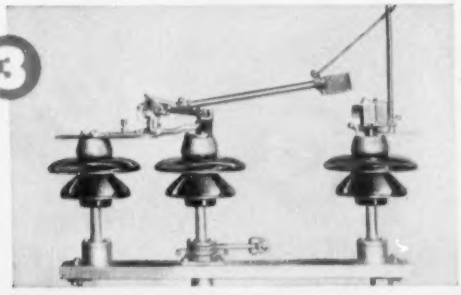
That's the way it is with Hi-Voltage Switches. Their fundamental design is NOT NEW. Rather, their exclusive "IN-OUT-UP" action has completely and successfully passed the test of time for over 33 years.

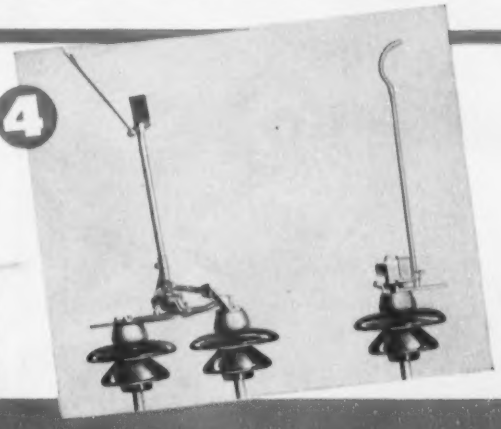
These switches assure Certain Operation any time . . . under any condition. Switches installed years ago take today's short circuits and overloads in stride . . . despite the rigors of northern winters and the deleterious effects of industrial corrosion.

HI-VOLTAGE

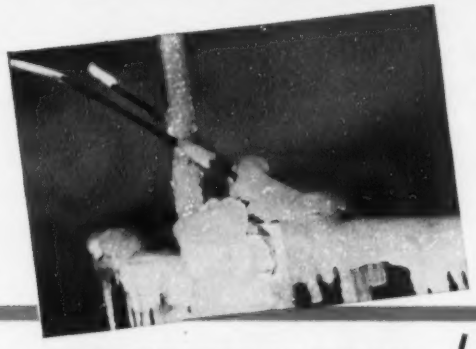








The "IN-OUT-UP" motion of Hi-Voltage Switches is the main reason for their unexcelled Service Records. Note that there is no undue stress or strain on any part of these switches. THERE IS NO TWISTING OR TURNING of switch arms and blades. The lateral bayonet-like thrust in and out of the contacts provides the easiest possible operation and the maximum mechanical advantage for ice and corrosion-seal breaking.



THE ICE-BREAKER CONTACT HOUSING

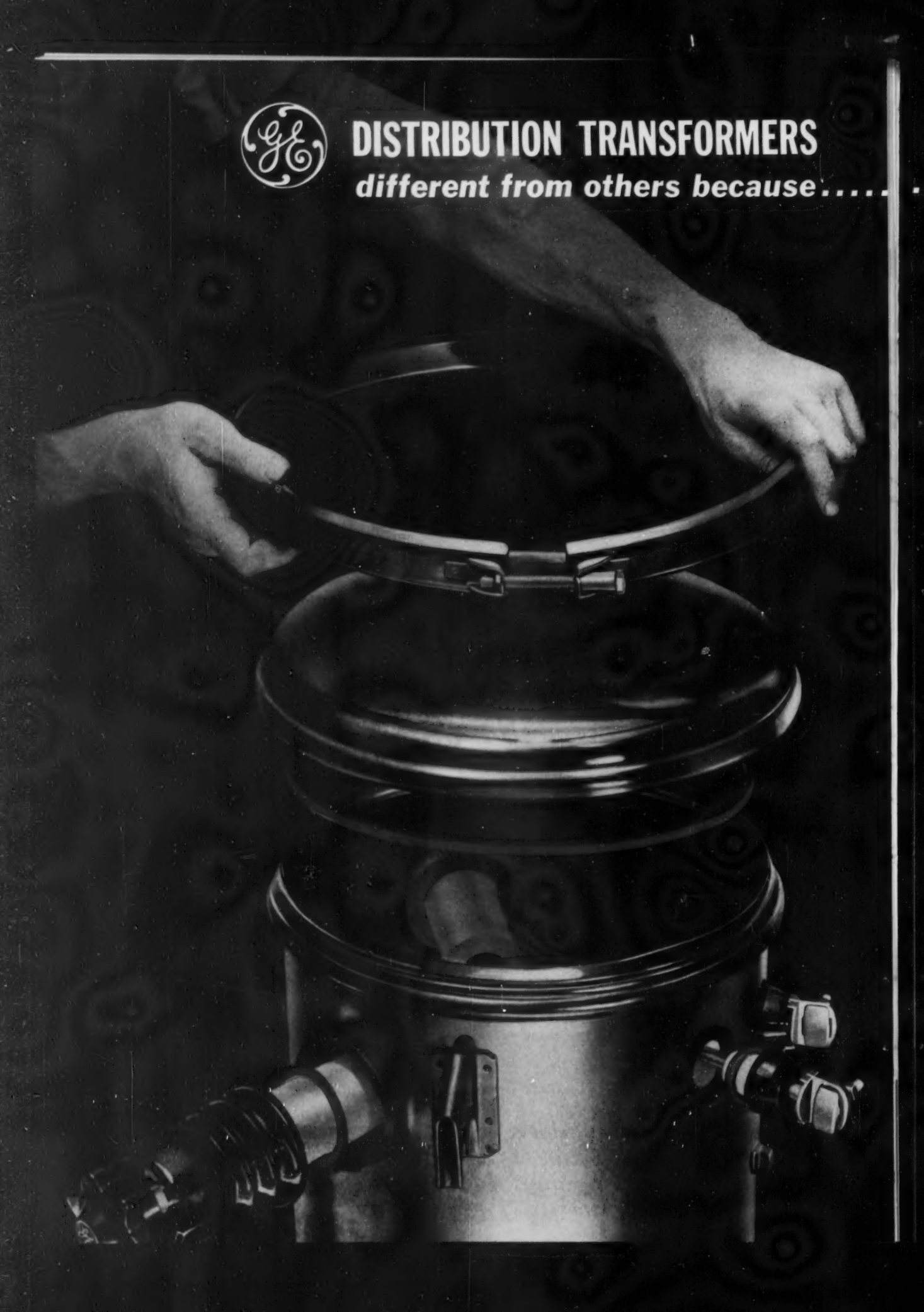
Whether the switch is closed or open during ice formation makes no difference. Operation is positive and certain. In the instance shown here, spray was directed into the blade end of the contact housing until more than an inch of ice had accumulated. Then the switch was closed at the speed of motor operation . . . not slammed. Operation was positive and CERTAIN with no hesitation.

The EXCLUSIVE "IN-OUT-UP" action is just one of the many outstanding features of Hi-Voltage Switches. Ask your Joslyn Representative about:

SILVER positive-pressure contacts.
MONEL BALL BEARINGS that never require any lubrication.
DIRECT MECHANICAL operating mechanism.
LOWEST POSSIBLE installation costs.

HI-VOLTAGE EQUIPMENT COMPANY

4000 EAST 116TH STREET • CLEVELAND 5, OHIO


DISTRIBUTION TRANSFORMERS
different from others because.....

....Nitrile rubber gaskets at *all* tank openings prevent breathing...seal out contamination

You get years of extra service from your General Electric Spirakore* distribution transformer because "we stopped their breathing to prolong their life." **EVERY OPENING**—cover, handhole, high- and low-voltage bushings—is sealed with a nitrile rubber gasket. These gaskets resist oil, sunlight and atmosphere . . . they require no cement . . . are easily removed *and used again and again.*

This air-tight seal maintains the high dielectric strength of the oil . . . prolongs the life of the insulation.

REMEMBER . . . all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

For more information on distribution transformers, either unit-type or conventional, contact your nearest G-E sales office, agent or distributor, or write to General Electric Company, Section 431-5, Schenectady 5, New York.

*Registered trade-mark of General Electric Co.

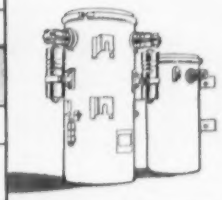
You can put your confidence in—

GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE

(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES



UNIT-TYPE CONVENTIONAL

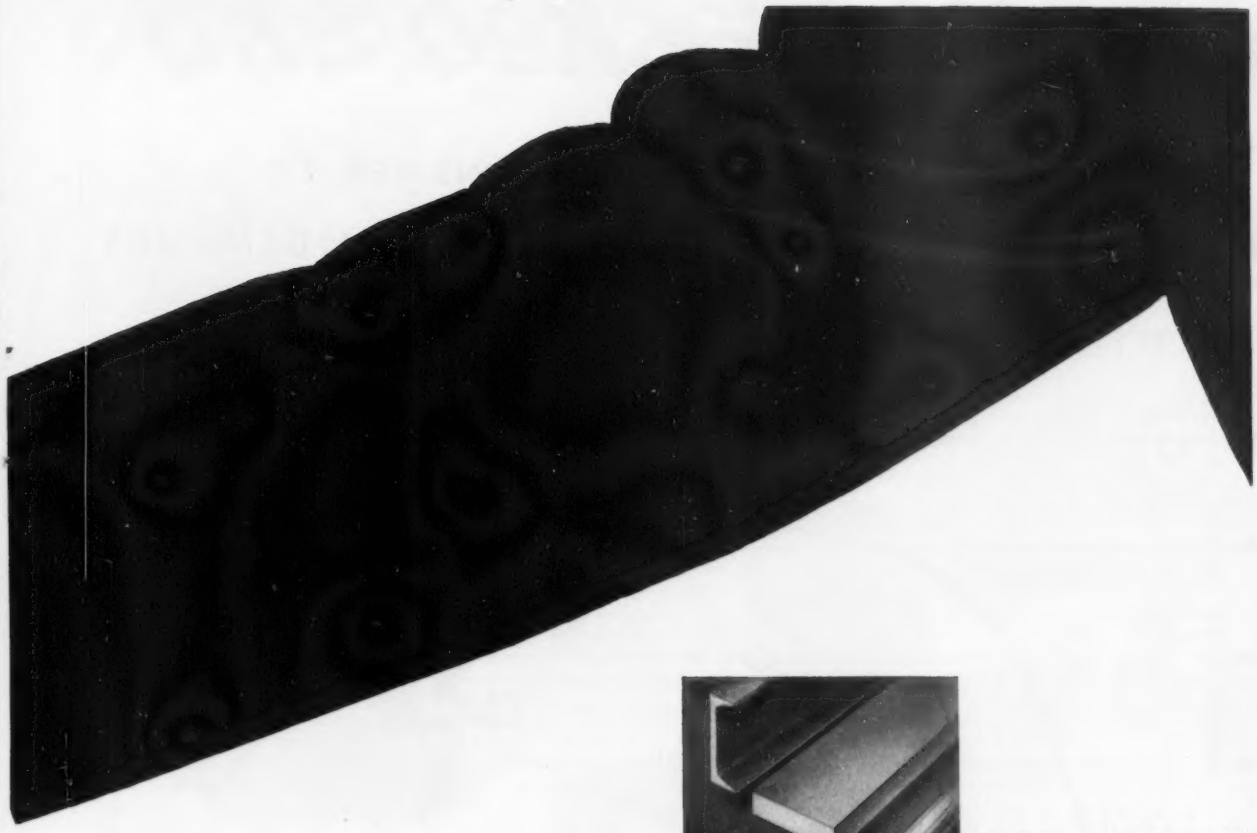
"Take your choice G. E. makes both"

Let's face facts!

It's easier—and cheaper—to follow the leader than to pioneer products. Trail blazing of fittings for the electric light and power industry, for example, costs money. More money than many companies, eyeing their profit pictures, are willing to invest.

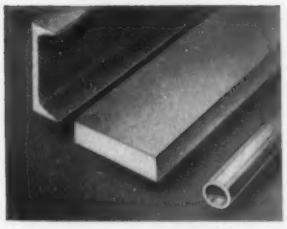
But, 55 years ago, when Alcoa started making aluminum accessories, there were none to copy. More than two million miles of transmission line depend on aluminum accessories today because of work we did. Thousands of heat runs at our research labs

ALCOA ON TV brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow, Tuesday evenings on most CBS-TV stations.

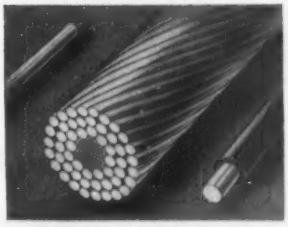


taught us the value of avoiding skimpy designs. Thousands of vibration tests at our physical testing labs taught us many basic design principles. Thousands of exposure tests on our own and customers' lines and at corrosion study centers taught us the importance of full recognition of the corrosion problem.

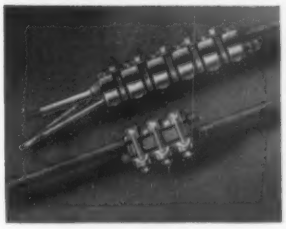
There is no substitute for Alcoa quality —you get just what you pay for. ALUMINUM COMPANY OF AMERICA, 2100-B, Alcoa Building, Pittsburgh 19, Pennsylvania.



Alcoa® Aluminum Bus is available in rectangular and solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include ACSR, solid and stranded aluminum wire, bare or covered.



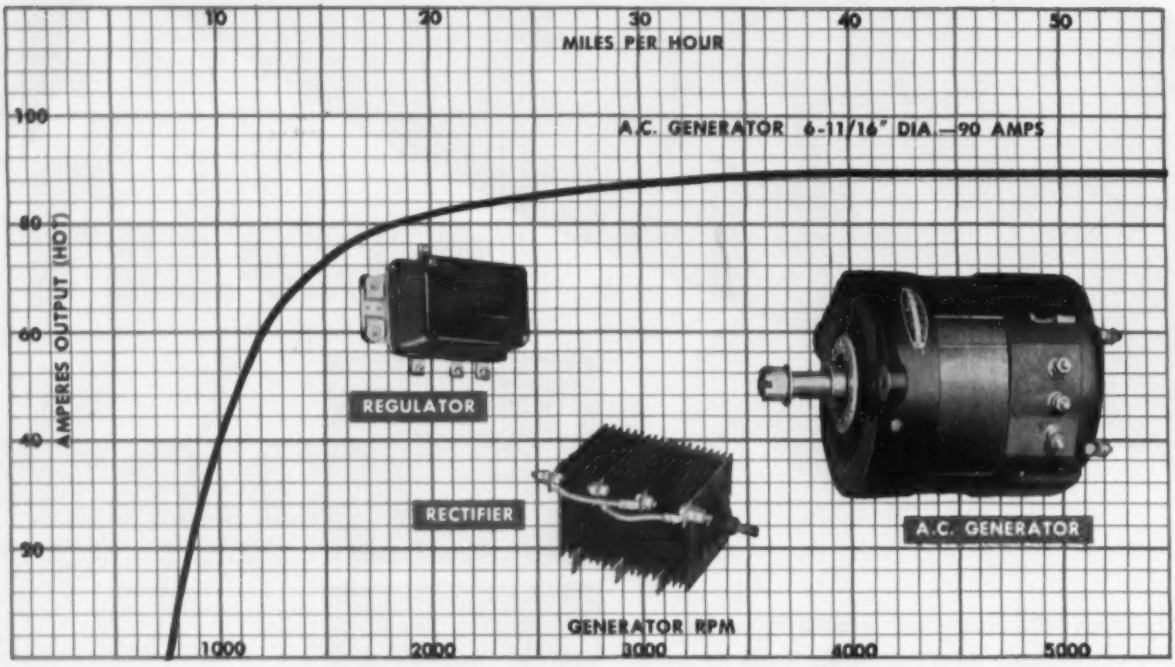
Alcoa's full line of aluminum accessories is correctly designed for use with all aluminum conductors.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Power Packed and

HERE'S THE A.C. ANSWER TO EXTRA-HEAVY ELECTRICAL DEMANDS



DELCO-REMY

A. C. Generator, Regulator and Rectifier

Here's the answer for "problem" vehicles—Delco-Remy's new long-lived A.C.-D.C. charging system! It's specifically designed to meet the *extra*-heavy electrical demands of public utility trucks and other vehicles equipped with two-way radio, floodlights or any extra electrical units . . . ample current reserve picks up discharged battery quickly in operation. Delco-Remy A.C. generators are suitable for use at all engine speeds.

With output ranging from 30-40 amperes at curb idle and up to 90 amperes at higher engine speeds, the new Delco-Remy A.C.-D.C. charging system meets all electrical needs under the toughest operating conditions. Included in the new system is the A.C. generator, a matching regulator, and a rugged, dependable dry-plate rectifier which converts generator A.C. output to direct current.

Application packages complete with installation instruction sheets for popular makes of cars and trucks are now available. The conversion job is simple. For further details and application data, see your nearest United Motors distributor.

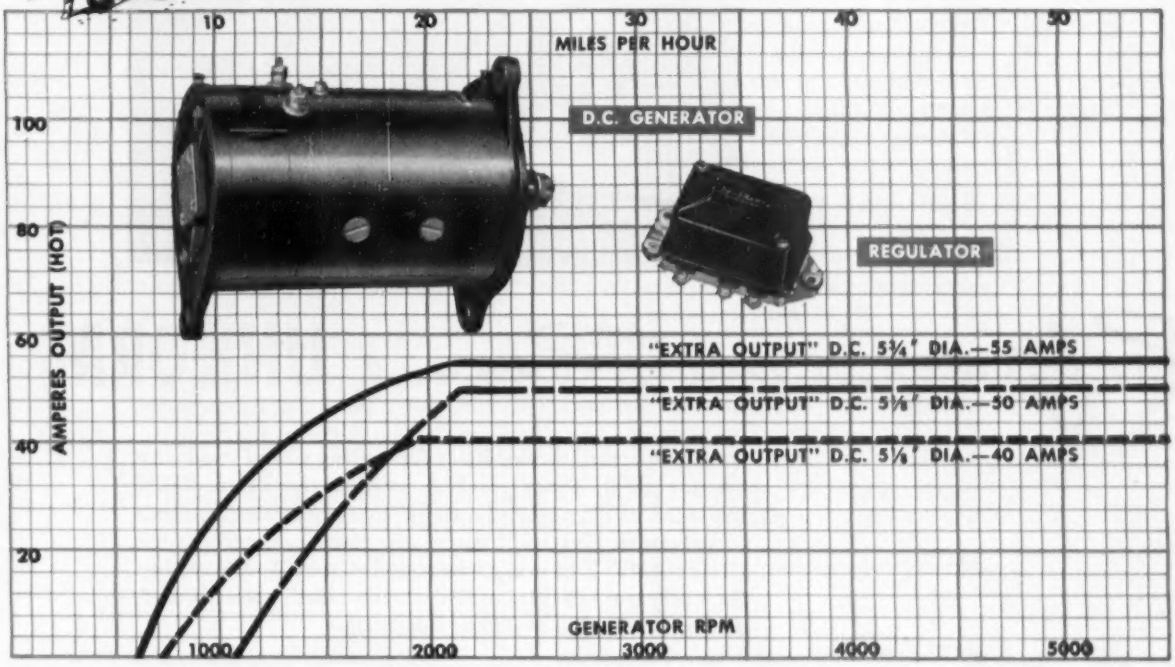
A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE

DISTRIBUTED BY WHOLESALERS EVERYWHERE

WHEREVER WHEELS TURN OR PROPELLERS SPIN

Right for the Job

HERE'S THE D.C. ANSWER TO HEAVY ELECTRICAL DEMANDS



DELCO-REMY

Extra-Output D. C. Generators and Matching Regulators

Delco-Remy extra-output D.C. generators are an economical answer to the electrical needs of public utility pickup or panel trucks as well as other vehicles with additional lights, two-way radios, or other special electrical equipment in medium to heavy-duty service. Delco-Remy extra-output D.C. generators are low in cost, simple to install, economical to maintain.

DELCO-REMY 40-AMP GENERATOR has low cut-in, about 7 mph, charges from 11 to 17 amperes at curb idle . . . full output about 18 mph —for vehicles customarily used in heavy traffic.

DELCO-REMY 50-AMP GENERATOR has slightly higher cut-in, about 11 mph . . . full output about 21 mph—for vehicles customarily operated at higher speeds, with minimum slow driving.

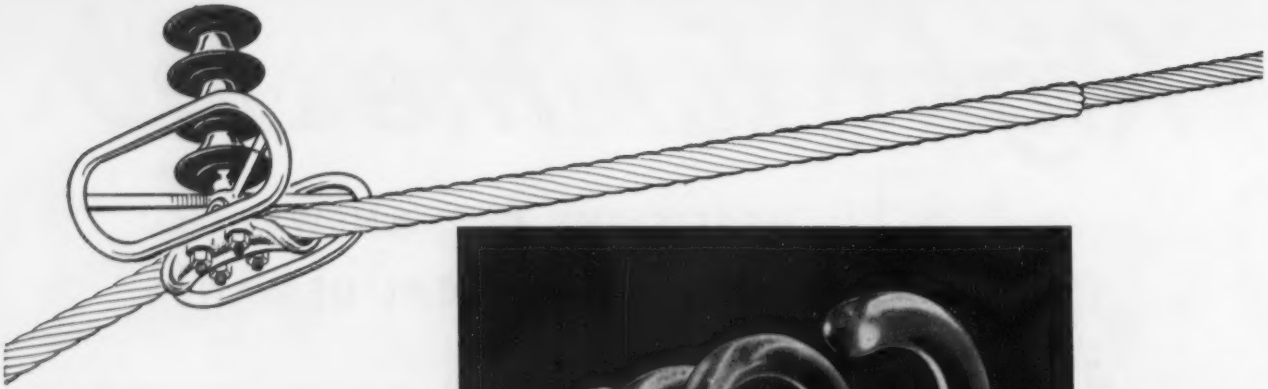
DELCO-REMY 55-AMP GENERATOR has very low cut-in, about 6 mph; charges at curb idle from 20 to 30 amperes . . . attains full output at 20 to 25 mph—for vehicles customarily operated at low speeds with added electrical loads, such as city taxicabs and police cars.

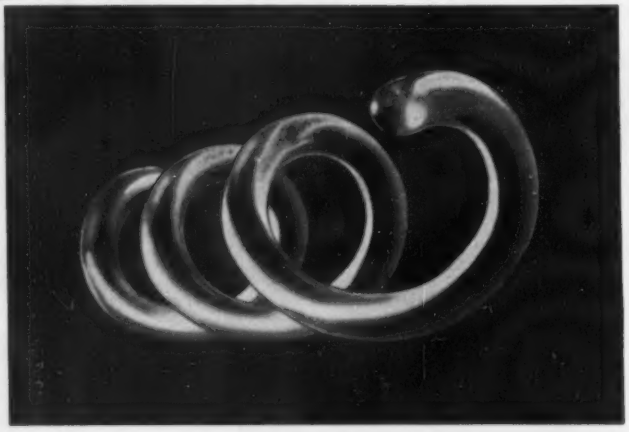
For further details and application data, see your nearest United Motors distributor.

Delco-Remy

DIVISION, GENERAL MOTORS CORPORATION, ANDERSON, INDIANA

WHEREVER WHEELS TURN OR PROPELLERS SPIN





Preformed Armor Rods are UNIFORM

● All Preformed Armor Rods for a given size of conductor are identical. Every pitch is exactly the same. THIS UNIFORMITY, obtained only by "factory-forming" the rods in precision dies with automatic machines, assures the UNIFORMITY of every Preformed Armor Rod assembly. Such inherent UNIFORMITY is maintained, not deformed, during installation or during operation.

PLP UNIFORMITY assures full efficiency of the armor regardless of the size of the conductor, ease of access to the application point, and the skill of the lineman installing it. With Preformed ARMOR rods, no special tools or wrenches are required. Easily installed by hand or hot-line tools, their field service performance can be predicted accurately.

Because the *gripping* action of Preformed Armor Rods is "built-in", they require no end-clamps; they are engineered to retain their initial intimate contact with the conductor throughout their service life . . . nothing to loosen.

For complete details of their exclusive advantages, write or telephone Cleveland: EXpress 1-3571.

PREFORMED ARMOR RODS:

1—Are "factory-formed" to the individual conductor.
2—Reduce substantially installation time.
3—Increase the effective rigidity of the conductor.
4—Minimize fatigue at suspension clamps . . . lengthen conductor life.
5—Have predictable field service performance.
6—Increase conductance of conductor.
7—Are reusable.

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

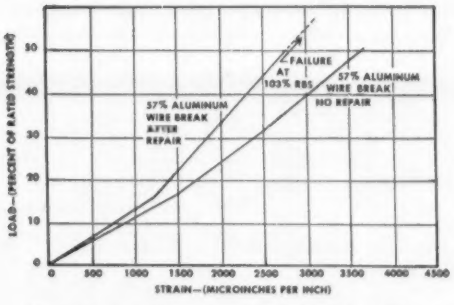
HOW Preformed Armor Rods LENGTHEN CONDUCTOR LIFE

★ The most vulnerable spot of a transmission line is under the suspension clamp. You can get no better armor protection than Preformed Armor Rods. They are always *uniform*—always do the same perfect job—factory engineered and factory formed—no variation in installation. Their intimate contact with the conductor provides the necessary reinforcement without any of the rub or chafe between rods and conductor, which you might expect in a looser installation. Furthermore, they will never loosen. They are not dependent on tightening of bolts which might crush the conductor if improperly applied—and which may become loose.

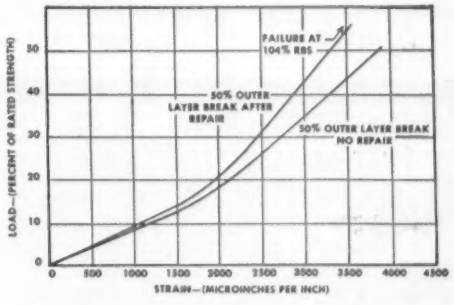
But this is only part of the story: While Preformed Armor Rods will provide the *best* and *safest* protection, they have another *unique* function—they do a job which only Preformed Rods can do. Regardless of armor efficiency, some vibration damage may occur. Should a strand failure occur at the suspension point, Preformed Rods will automatically take on the load, restoring strength and conductance—thereby continuing and lengthening conductor life.*

After all, your interest is in maintaining service—in continued functioning of your transmission lines. You need no longer consider the life of your conductor jeopardized by a strand failure. Preformed engineering has seen to this.

* Many have encountered vibration, chafing and burning failures on unarmored conductors and have used Preformed Armor for repairing and restoration of conductors at those points.



Strength restoration of No. 4, 7 x 1 ACSR (rated breaking strength—2288 lbs.) by Preformed Armor Rods.

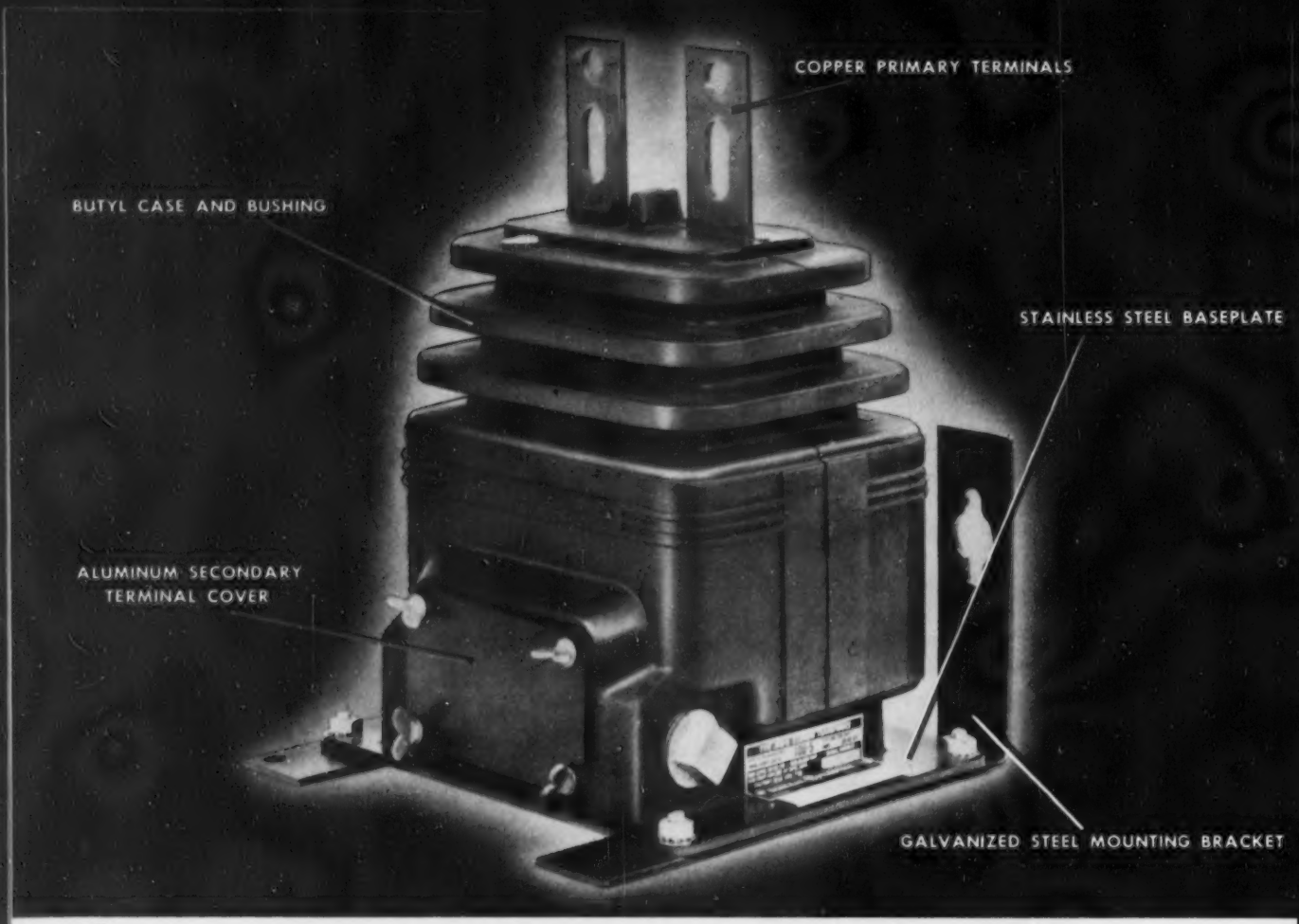


Strength restoration of 795 MCM, 26 x 7 ACSR (rated breaking strength—31,200 lbs.) by Preformed Armor Rods.

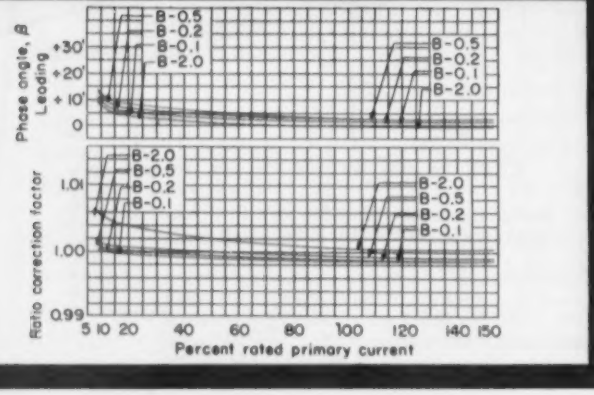
These two charts tell the story. Irrespective of conductor size and construction, the clamping characteristics of PREFORMED Armor Rods result in restoration of the strength of damaged conductors to within at least 5 per cent of the rated breaking strength of the original conductors. And remember . . . only with PREFORMED Armor Rods . . . can laboratory tests accurately predict field service performance. There are no "average" installations.

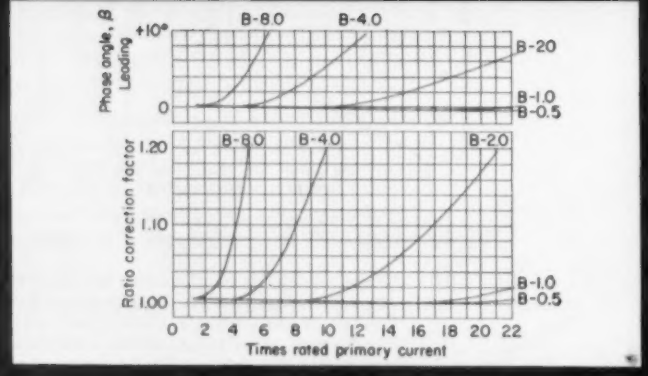
SALES REPRESENTATIVES:

C. B. Anderson Co., *Tulsa* ● **Bergstrom-Verbarg Co.,** *Minneapolis* ● **Vincent J. Brown Co.,** *Buffalo* ● **Burns Electric Co.,** *Pittsburgh* ● **Earl S. Condon Co.,** *Los Angeles* ● **Cory and Crum,** *Indianapolis* ● **The Electrical Distributors Co.,** *Philadelphia* ● **Engineer Sales Co.,** *St. Petersburg* **JSG Electric Co.,** *Chicago* ● **E. L. Flowers,** *Boston* ● **George R. Horne & Co.,** *Dearborn* ● **Johnson Sales Co.,** *Bay City* ● **H. L. Macon & Co.,** *Atlanta,* **Peterson Co.,** *Denver* ● **Elgin B. Robertson, Inc.,** *Dallas* ● **Elgin B. Robertson Co.,** *Houston* ● **K. M. Ryals Co.,** *San Francisco* ● **Shaffer and Nelson,** *Portland, Seattle, Spokane* ● **M. H. Snyder & Sons,** *New York* ● **Curtis H. Stout,** *Little Rock, Memphis, New Orleans* ● **L. H. Wendegatz,** *Kansas City*



1 **CORROSION-RESISTANT** materials—butyl, stainless steel, aluminum, galvanized steel, copper reduce maintenance to minimum.





5

Burden	Imp.	V-A	P-f
B-0.1	0.1	2.5	0.9
B-0.2	0.2	5.0	0.9
B-0.5	0.5	12.5	0.9
B-2.0	2.0	50.0	0.5

HIGH ACCURACY of new G-E current transformer is illustrated in these characteristic ratio and phase angle curves at 60 cycles. At left: 10 to 800 amperes, with normal current; at right: 10 to 800 amperes, up to 22 times rated primary current.

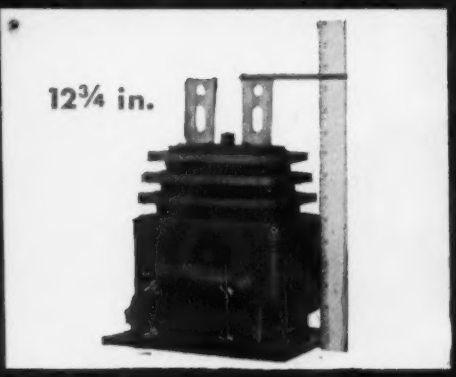
Burden	Imp.	V-A	P-f
B-0.5	0.5	12.5	0.9
B-1.0	1.0	25.0	0.5
B-2.0	2.0	50.0	0.5
B-4.0	4.0	100.0	0.5
B-8.0	8.0	200.0	0.5

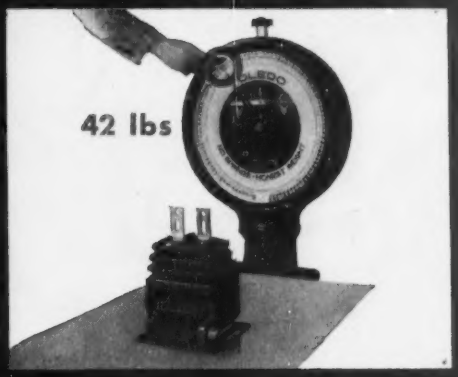
New JKW-3 is suitable for accurate metering down to 5% of rating and for relay operation up to twenty times rated current. The ASA accuracy classification of this transformer is 0.3 at burdens: B-0.1 to B-2.0.

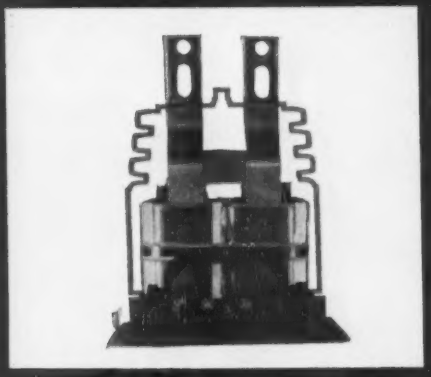
GENERAL ELECTRIC ANNOUNCES

A 5000-volt butyl-molded current transformer for outdoor applications

NEW TYPE JKW-3 OFFERS SIX MAJOR FEATURES



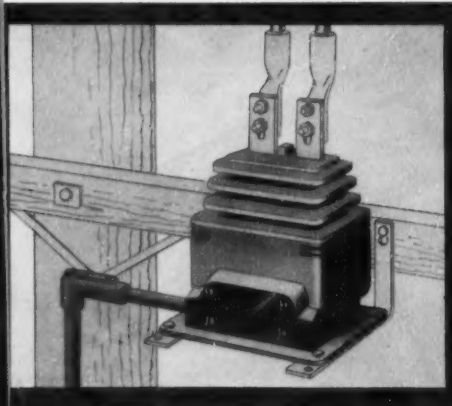


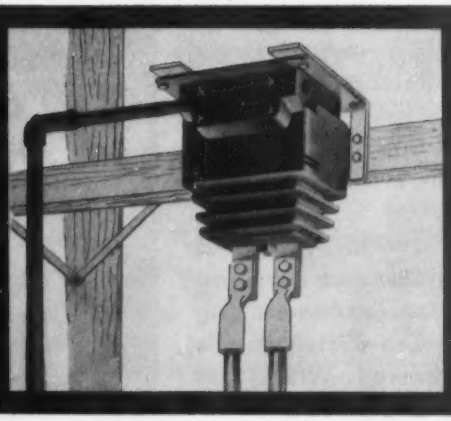


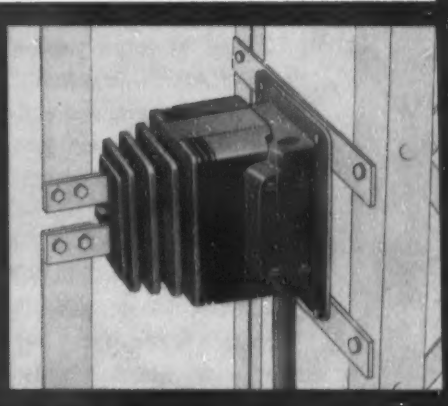
2 **ONE THIRD SMALLER** in all ratings than other top-connected 5 KV designs, the new General Electric JKW-3 transformer is easier to install.

3 **LIGHT WEIGHT** of current transformer, only 42 pounds, facilitates handling and installation. Weighs 1/3 less than other top-connected 5 KV outdoor designs.

4 **UNIFIED CONSTRUCTION OF JKW-3** assures high mechanical strength. Butyl serves as insulation, case, and bushing.







6 **VERSATILE MOUNTING,** the new General Electric JKW-3 transformer is applicable to bottom-, top- or side-connected installations. It can be platform-mounted, bolted directly to a crossarm, or attached by U-bolts or suspension hooks. This versatility of positioning and mounting reduces installation cost. Two L-shaped brackets are supplied with each transformer. Auxiliary L-brackets for U-bolt mounting and suspension hooks are available upon request.

FOR MORE INFORMATION on the new G-E 5000-volt outdoor current transformer, contact your nearest G-E representative, or write for Bulletin GEC-1222 to Section 604-39, General Electric, Schenectady 5, N. Y.

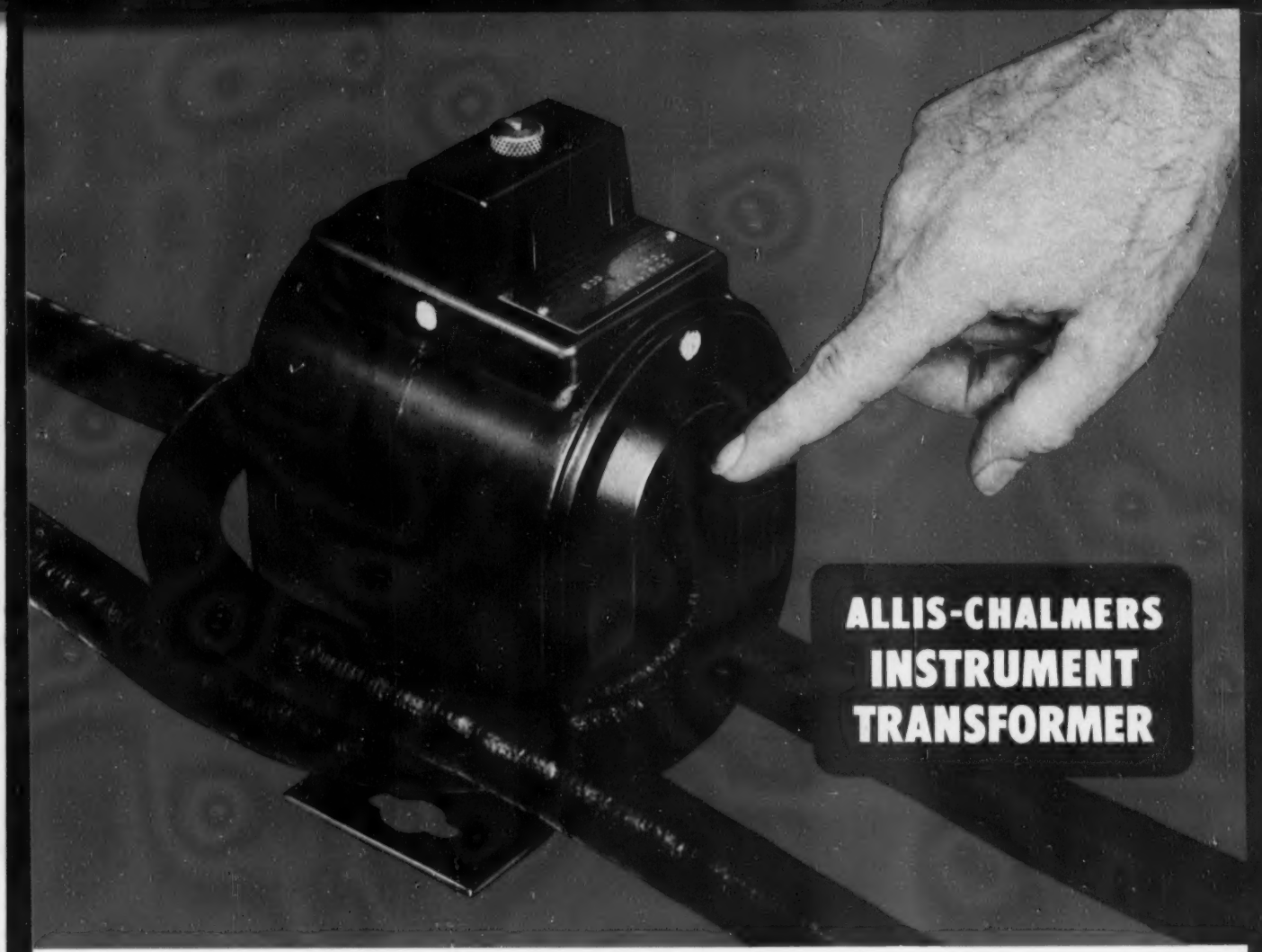
GENERAL ELECTRIC

12 tons of force yet only 12 pounds of weight makes AMP's new hand hydraulic tool your best bet for rugged, dependable installation of these *precision-engineered* power terminals. Terminals and connectors are available in all ranges from #8 to #4/0. DESIGNED FOR USE ON ALL SHAPES OF WIRE: SOLID, STRANDED, SQUARE, OVAL, OR COMBINATIONS! Dies snap in and out easily. Tool automatically releases when crimping pressure is reached. Can be used with either pole strap or bench stand if desired. WRITE FOR SPECIAL POWER TERMINAL CATALOG.

AMP Trade Mark Reg. U.S. Pat. Off. © AMP

AMP

AIRCRAFT-MARINE PRODUCTS INC.
POWER TERMINAL DIVISION
2100 Paxton Street, Harrisburg, Pa.



Thru-Type Transformer with Oval Window Holds More Conductors

There is more room for conductors in the new type TWM Allis-Chalmers 600 volt indoor-outdoor current transformer than in any other thru-type current transformer of corresponding rating now on the market. The oval window (dimensions: 1⅜ by 2¾ inches) is large enough to hold two 500 MCM stranded conductors with 600 volt insulation. Yet the Type TWM A-C current transformer is lightweight and compact. It is small enough for multiple mounting in standard instrument transformer enclosures. It is molded in thermo-setting resin.

Installation is simple. You can mount them in any position — they have special provision for different mounting needs. Connections can be made faster than on previous current transformer designs. It is possible to obtain a number of different ratings from a single unit.

A-4220

Detailed Information Inside

ALLIS-CHALMERS

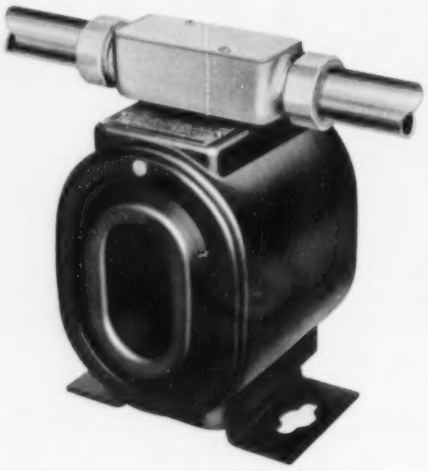
Connection Time Reduced By Thru-Type Design

Installation time of through-type transformers is greatly reduced because bolted primary connections are eliminated with the thru-type design. Elimination of bolted connections also simplifies future change-over caused by load growth.

For permanent identification, primary and secondary polarity markings are molded directly into the resin. An etched stainless steel nameplate on top of the unit contains all essential information for correct operation.

Left: Secondary terminals are located at top of transformer. This permits mounting transformers close together when necessary. Terminals are non-corrodible studs with ¼-28 thread. A weather-resistant sealable cover (shown in lower photograph) protects terminals and may be turned to permit making connections from either side.

Right: If desired, a standard conduit box can be substituted for the molded terminal block and cover. It is only necessary to drill two holes in the conduit box and install with insulating washers. All connections can be made quickly.

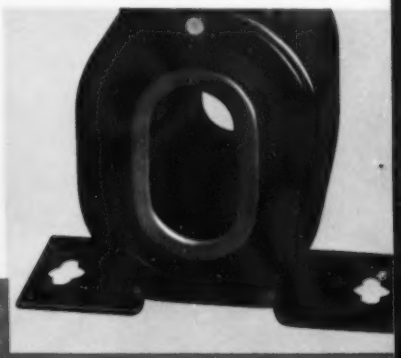


Mount It in Any Position

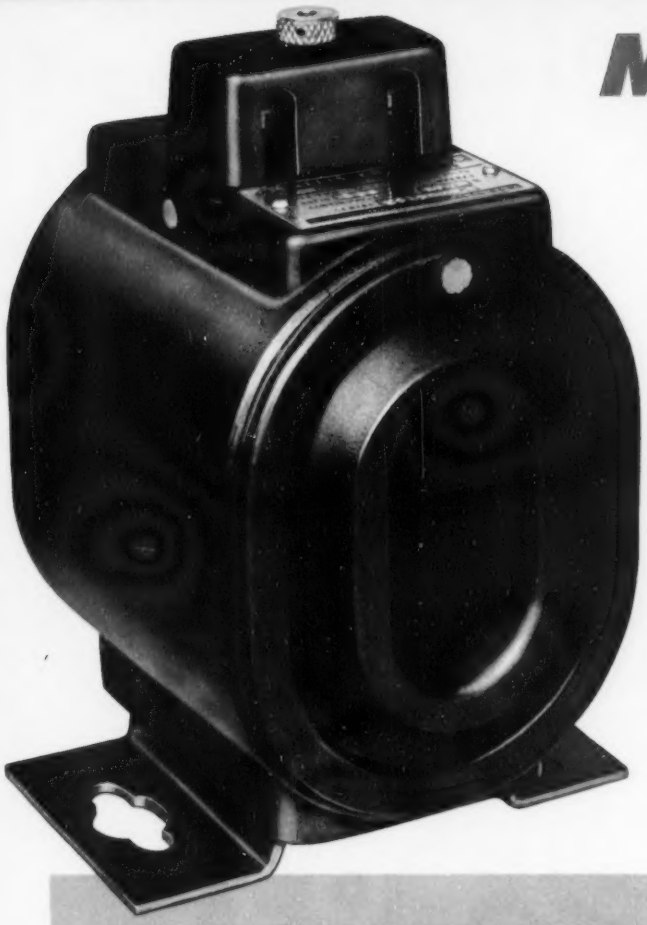
Type TWM current transformer can be mounted in any position — vertically, horizontally, or inverted. No hangers or enclosing boxes are required.

The base is a formed steel plate bolted with cap screws onto inserts anchored in the assembly. It can be rotated 90 degrees by using an alternate set of bolt holes. Picture at lower left shows base in conventional position; at center below shows base rotated.

The standard base has 4¼ inch mounting centers. An optional base is available with 6¼ inch mounting centers (shown below, right). No charge is made for optional base if specified when ordering.



ALLIS-



Maintenance Eliminated!

Allis-Chalmers new type TWM thru-type current transformer is molded in thermo-setting resin. It requires no painting. It has an inherent toughness that promotes long life and resistance to all kinds of weather. The molded resin serves as insulation, support, and casing for the transformer.

Only the secondary terminal inserts and the base mounting inserts protrude from the molded body. A perfect seal is established because of the excellent adhering qualities of the material used in the molding process.

TRANSFORMER ACCURACY

The Type TWM current transformer is designed for high accuracy with a burden of one or more watthour meters. The ASA accuracy classification is shown in the chart at left.

Amperes	Burden	
	B-0.1	B-0.2
	Accuracy	Class
200	0.3	0.6
400, 600, 800	0.3	0.3

Thermal Ratings: The 200, 400, and 600 ampere transformers can be operated continuously at 200% of rated current. The 800 ampere transformer can be operated continuously at 150% of rated current.

Ratings Available: Type TWM current transformer is manufactured in four primary current ratings. They are 200, 400, 600, and 800 amperes. However, intermediate ratings may be obtained by passing the primary conductor through the window two or more times.

When the unit is used as a three-wire transformer, the two outside conductors are passed through the window, with one conductor being looped through the window in the reverse direction. The chart below shows ratings for two- and three-wire service.

Ratings							
Two-Wire Service				Three-Wire Service			
One Turn of Primary Conductor		Two Turns of Primary Conductor		One Turn of Each Primary Conductor		Two Turns of Each Primary Conductor	
Amperes	Ratio	Amperes	Ratio	Amperes	Ratio	Amperes	Ratio
200 to 5	40:1	100 to 5	20:1	100/100 to 5	20:1	50/ 50 to 5	10:1
400 to 5	80:1	200 to 5	40:1	200/200 to 5	40:1	100/100 to 5	20:1
600 to 5	120:1	300 to 5	60:1	300/300 to 5	60:1	150/150 to 5	30:1
800 to 5	160:1	400 to 5	80:1	400/400 to 5	80:1	200/200 to 5	40:1
Transformer Weight (All ratings) NET . . . 14 lbs. SHIPPING . . . 16 lbs.							

CHALMERS

A-C ALLIS-CHALMERS

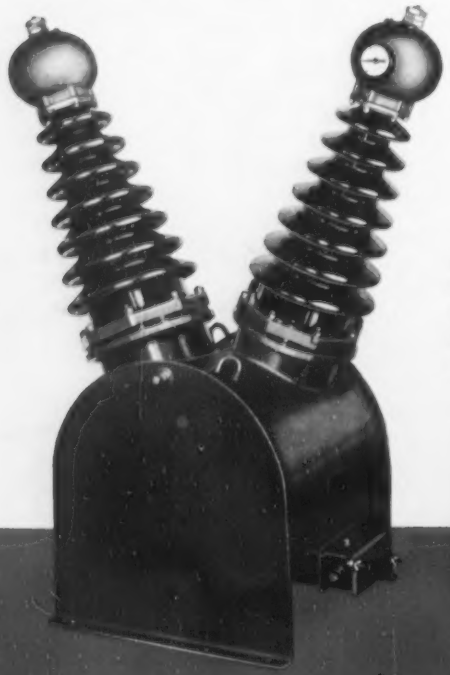
Compact, Lightweight Transformers Save Space, Speed Installation

Less floor space is needed with Allis-Chalmers complete line of oil-insulated outdoor current and potential transformers for circuits 69 kv and below. In addition, their advanced design cuts weights up to 40%, resulting in units that are easier to handle than older designs. You get greater insulation strength and higher thermal ratings than could be provided previously.

CORONA-FREE DESIGN

Corona is kept from developing — another step toward extending transformer life. Tanks are all-welded and hermetically sealed to protect insulation and oil from sludge formation. The unique bushing construction permits circulation of oil through bushing and transformer, saving on oil requirements and reducing transformer sizes.

Continuous long-time overvoltage tests for extended periods of time were made on transformers of all voltage classes. The units successfully withstood standard applied potential and impulse tests. Further tests, with the units purposely contaminated to give a resultant power factor many times higher than normal, successfully withstood the standard applied potential and impulse tests.



***Get all the facts** on these lightweight, modern transformers. Contact your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for more information.*

ALLIS-CHALMERS

INSTRUMENT TRANSFORMER

POTENTIAL

Rating	Floor Space	Height	Weight
SPW-2 24 kv	14½ x 14⅜	36½	252
SPW-3 34.5 kv	15½ x 16⅝	39	310
SPW-4 46 kv	19 x 19	49	615
SPW-6 69 kv	25½ x 24	61	1050

CURRENT

Rating	Floor Space	Height	Weight
SCW 25 kv	14" x 19"	42"	340
SCW 34.5 kv	14" x 19"	45"	355
SCW 46 kv	16" x 23"	55"	500
SCW 69 kv	16" x 23"	61"	565

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Milwaukee 1, Wisconsin

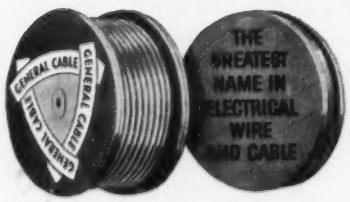
GENERAL CABLE

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

SAFETY M.I. WIRING SYSTEM

PERMANENT | FLEXIBLE | RUGGED | MOISTUREPROOF | RESISTS HEAT | SMALL DIAMETER SAVES SPACE

THE WORLD'S NEWEST, MOST VERSATILE ELECTRICAL WIRING!



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

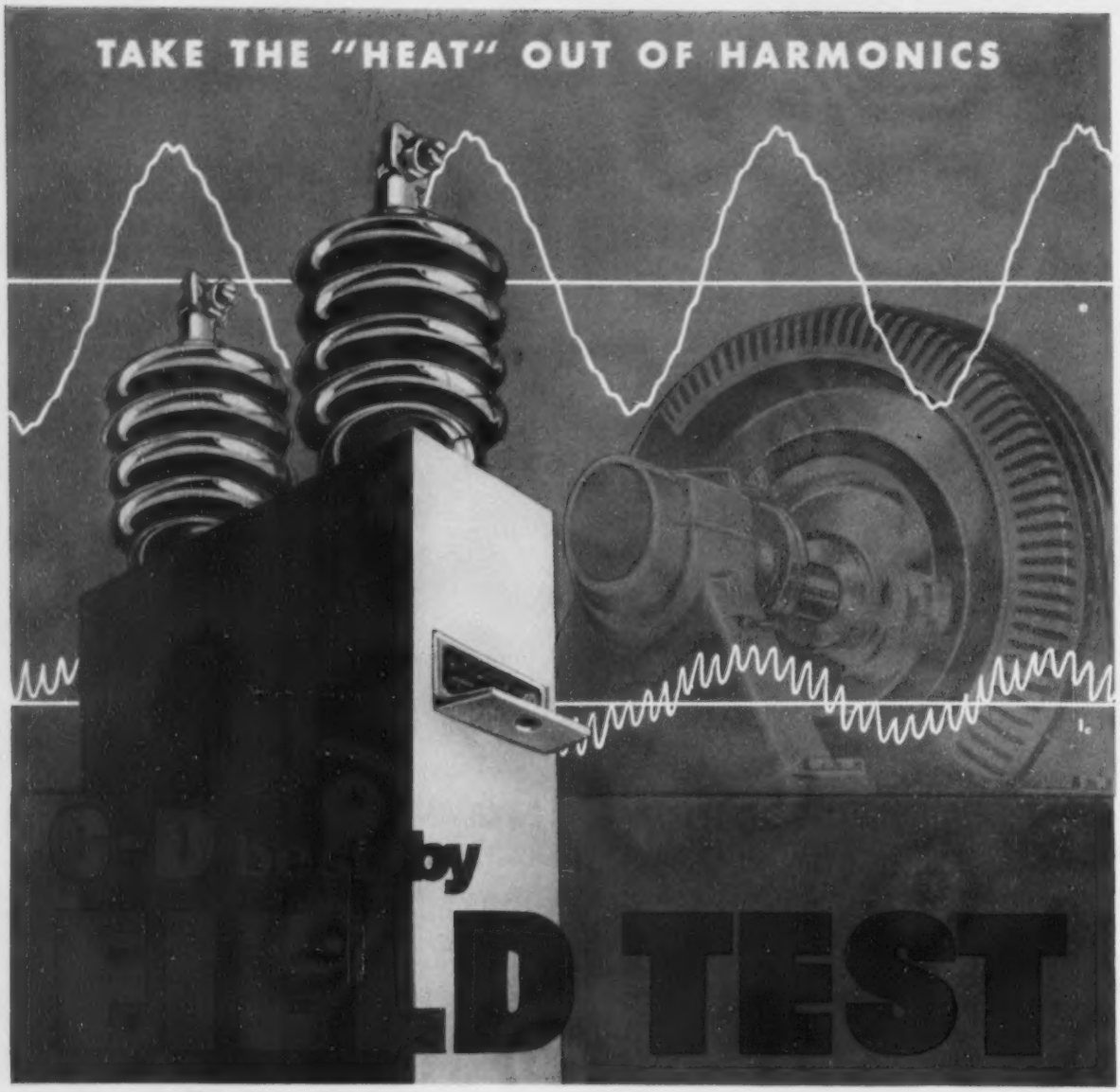
1953 Code Approved for wiring jobs up to 600 volts, Safety m.i. Wiring has proved its versatility for power, lighting and control. In power plants, industrial and commercial buildings, processing plants, ships and in dozens of other applications where deterioration is a major problem.

By acting as its own conduit... by unique flexibility and small diameter... Safety m.i. Wiring has further proved its ability to provide lower installed costs. For information on this amazing product, check General Cable today.

GENERAL CABLE CORPORATION Executive Offices: 420 Lexington Ave. New York 17, New York

Sales Offices: Atlanta • Buffalo • Cambridge (Mass.) • Chicago • Cincinnati • Cleveland Dallas • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee Minneapolis • New York • Newark (N. J.) • Philadelphia • Pittsburgh • Portland St. Louis • San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.

TAKE THE "HEAT" OUT OF HARMONICS



by

LD TEST

e-wave form of voltage generated by an open slot type alternator of small kilovolt-ampere capacity.

I_c-capacitor current. The seventeenth harmonic in the voltage variation produces a pronounced seventeenth harmonic in the I_c variation.

There are more C-D capacitors in use today than any other make

C-D capacitors are especially designed to withstand the recognized damaging effects of high harmonic component currents associated with many of the earlier type alternators.

Again, C-D's built-in margin of safety permits the highest degree of trouble-free service under the most severe operating conditions.

We'll be glad to have one of our field engineers graphically demonstrate the dollar-saving economy utilities have enjoyed with their C-D capacitor installations. And why only C-D pre-delivery quality tests all power-factor capacitors at full rated voltage. Cornell-Dubilier Electric Corp., Dept.D-24a,South Plainfield, New Jersey.

ONSISTENTLY EPENDABLE

CORNELL-DUBILIER CAPACITORS

FOR POWER-FACTOR IMPROVEMENT

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY: THE RADIART CORPORATION, CLEVELAND, O.

New Chevrolet Trucks for '54

Loaded with brand-new advantages you need and want!

You'll get more work done in less time and at lower cost with new '54 Chevrolet trucks on the job. They bring you more new features . . . more big new advantages than any other truck on the road.

For example, you get new engine power in all models. The advanced "Thriftmaster 235" engine combines bigger displacement and higher compression with other new features to give you greater power and finer performance. The rugged "Loadmaster 235" engine offers increased strength and stamina for heavier trucking operations. The all-new "Jobmaster 261" engine* brings you extra reserves of high-compression power for hauling big loads on schedule.

In addition, you enjoy new and even greater operating economy. All three 1954 Chevrolet truck engines bring you the full benefit of thrifty high-compression power.

And there are many, many more new things you'll like about these great new Chevrolet trucks. New, roomier pickup and stake bodies let you haul more . . . save you time and extra trips. And they're set lower to the ground for easier loading and unloading. New truck Hydra-Matic transmission* lets you drive all day without shifting. It's offered not only on ½- and ¾-ton Chevrolet trucks, but on 1-ton models, too. New Comfortmaster cab with one-piece curved windshield and amazing new Ride Control Seat* offers the last word in comfort, convenience and safety.

Plan now to see your Chevrolet dealer and get all the facts about the new Chevrolet trucks for '54. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Most trustworthy trucks on any job!

CHEVROLET

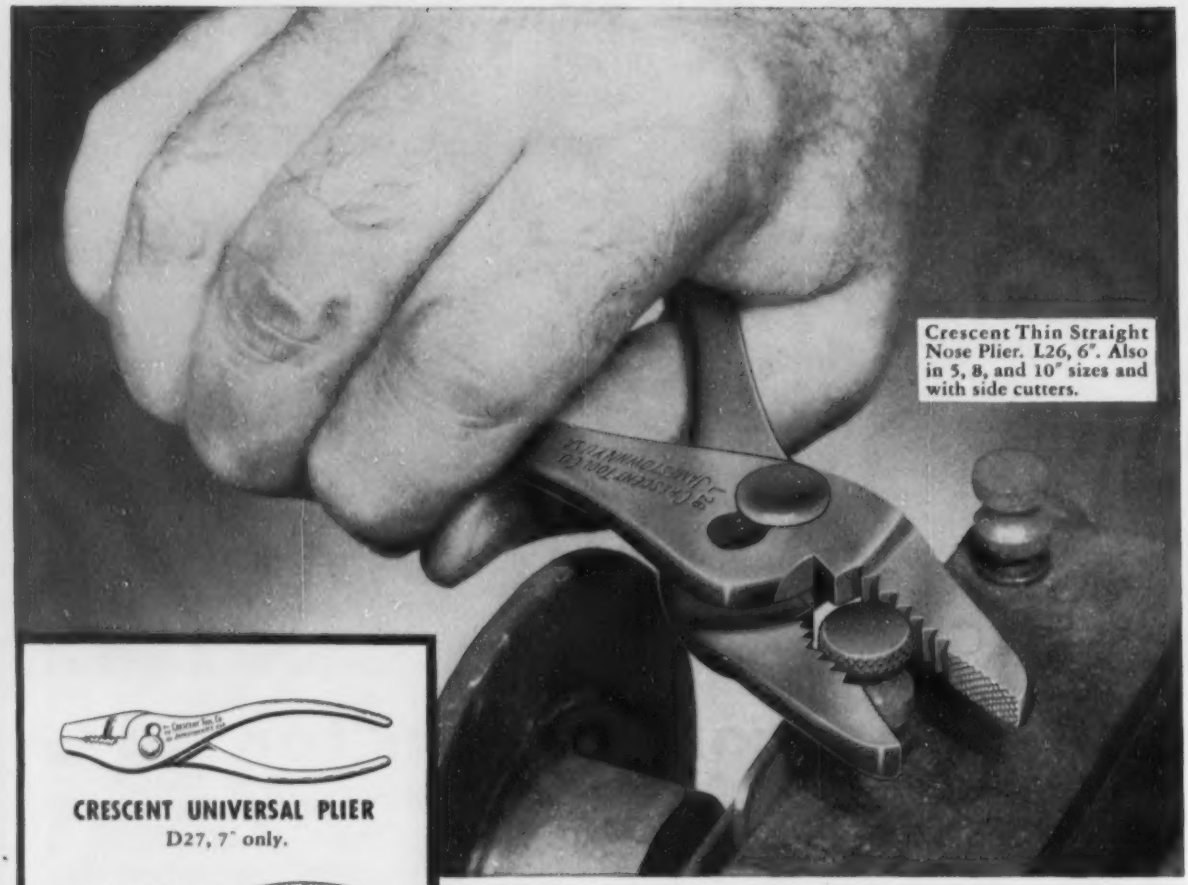
ADVANCE-DESIGN TRUCKS

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

THREE GREAT ENGINES—The new "Jobmaster 261" engine* for extra heavy hauling. The "Thriftmaster 235" or "Loadmaster 235" for light-, medium- and heavy-duty hauling. **NEW TRUCK HYDRA-MATIC TRANSMISSION***—offered on ½-, ¾- and 1-ton models. Heavy-Duty **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **DIAPHRAGM SPRING CLUTCH**—improved-action engagement. **HYPOID REAR AXLE**—for longer life on all models. **TORQUE-ACTION BRAKES**—on all wheels on light- and medium-duty models. **TWIN-ACTION REAR WHEEL BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—greater holding ability on heavy-duty models. **NEW RIDE CONTROL SEAT***—eliminates backrubbing. **NEW, LARGER UNIT-DESIGNED PICKUP AND PLATFORM STAKE BODIES**—give increased load space. **COMFORTMASTER CAB**—offers greater comfort, convenience and safety. **PANORAMIC WINDSHIELD**—for increased driver vision. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—easier, safer handling. **ADVANCE-DESIGN STYLING**—rugged, handsome appearance.

**Optional at extra cost. Ride Control Seat is available on all cab models, "Jobmaster 261" engine on 2-ton models; truck Hydra-Matic transmission on ½-, ¾- and 1-ton models.*

MORE CHEVROLET TRUCKS IN USE THAN ANY OTHER MAKE!



Crescent Thin Straight Nose Plier. L26, 6". Also in 5, 8, and 10" sizes and with side cutters.

CRESCENT UNIVERSAL PLIER
D27, 7" only.

MoToR KiT COMBINATION PLIER
G25, 5". Also in 6, 8, and 10" sizes.

CeeTeeCo COMBINATION PLIER
H25, 5". Also in 6, 8, and 10" sizes.

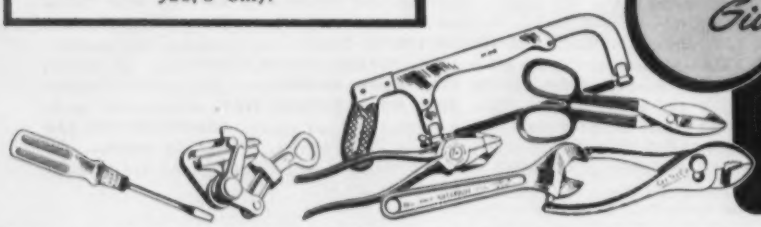
CRESCENT THIN BENT NOSE PLIER
J26, 6" only.

CRESCENT
SLIP JOINT PLIERS

Crescent offers a wide selection of styles and sizes in this widely used plier type. All are drop-forged from special analysis steel and finished in bright plate. They have sharply milled teeth, comfortable handles and smooth working joints. The joint bolt and nut are turned from solid bar steel and case hardened. Sold by Industrial Distributors and Hardware Dealers everywhere.

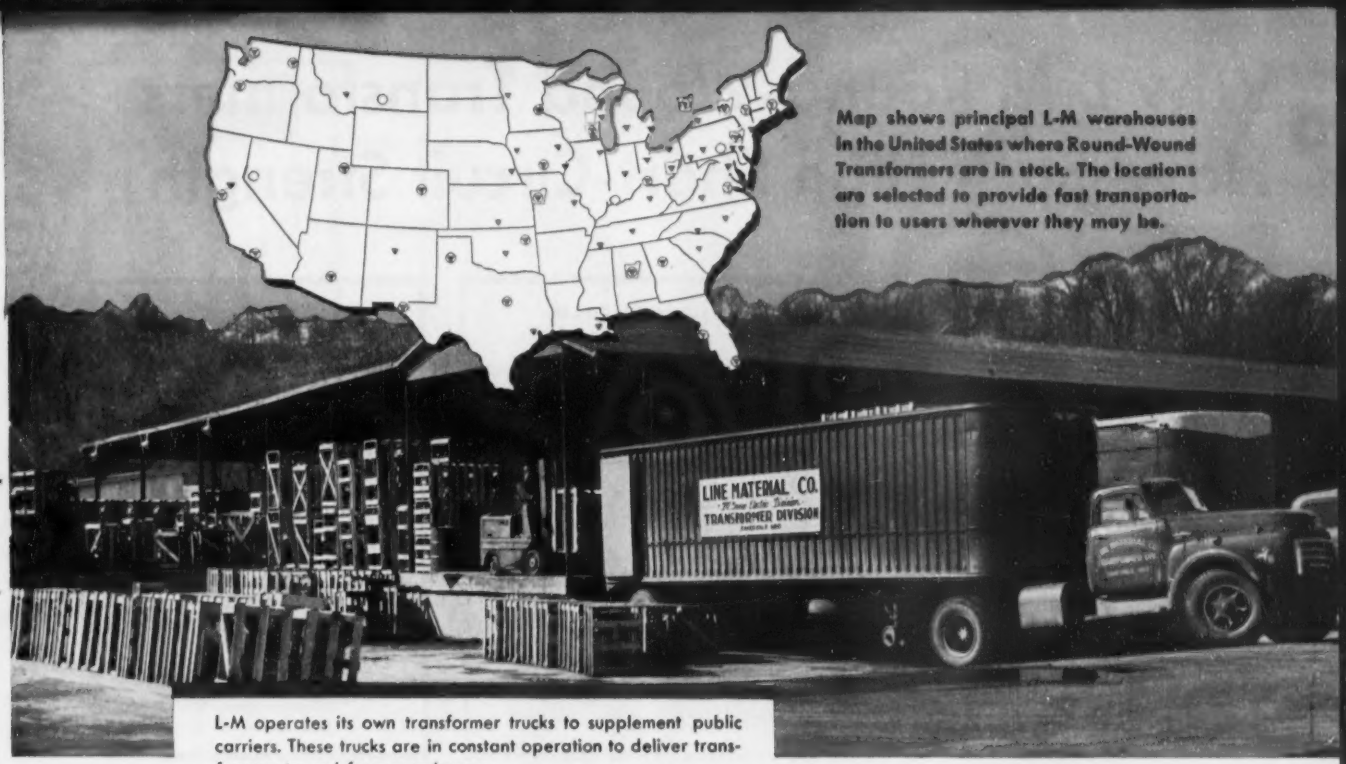
CRESCENT TOOLS
Give Wings to Work

Sign of the Artisan
Symbol of Excellence



Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



Map shows principal L-M warehouses in the United States where Round-Wound Transformers are in stock. The locations are selected to provide fast transportation to users wherever they may be.

L-M operates its own transformer trucks to supplement public carriers. These trucks are in constant operation to deliver transformers to and from warehouses.

Stocks in 45 Warehouses Assure Prompt Delivery of L-M Round-Wound Transformers

When you need an L-M Round-Wound Transformer fast, L-M can get it there. To take care of customer requirements, L-M years ago set up a system of strategically located warehouses. In recent years production has been substantially increased for the express purpose of augmenting these warehouse stocks. Today most sizes and ratings of L-M Round-Wounds are available in a warehouse near you.

This warehousing service has been designed especially as a "customer plus" service. Operations have been set up to speed the handling of orders. L-M has set up its own transformer truck fleet to provide additional flexibility and faster service in emergencies.

Crating has been designed both for the protection of the transformer and for the convenience of the user. Bases of the crates are designed for lift trucks. High grade heavy lumber is used to assure the greatest possible protection to transformers and bushings.

If you want outstanding transformers, and prompt delivery, ask the L-M Field Engineer about L-M Round-Wound Transformers. Or write for Bulletin DT1, to Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

132

Large stocks in all warehouses are designed so they will meet the needs of each particular area. In addition, a system of stock reporting makes it possible to transfer additional transformers promptly should a shortage develop at any one warehouse. Master stocks at the factory are crated, ready for prompt shipment.

"Round-Wound" is a Line Material Company trademark

LINE MATERIAL *Transformers*

Why L-M Round-Wound Transformers Have Such High Short-Circuit Strength

by **JAMES G. EVERHART**
Chief Engineer
Transformer Division
Line Material Company

One of the desirable characteristics of L-M Round-Wound transformers is their exceptionally high short-circuit strength. Partly this is inherent in the way we wind round coils on a wound core. But further, this strength arises from the exceptionally good mechanical design.

Effects of Short Circuits

Short circuits exert two forces—radial and axial. Under radial forces, rectangular coils tend to assume a round shape. Being already round, the coils on Round-Wound transformers resist these radial forces much better than do rectangular coils. (Figs. 1 and 2).

Axial forces tend to telescope the windings. Although failure is progressive, it can occur almost instantaneously. If the coil starts to telescope, the electrical centers of the coils are abnormally displaced. This results in a greater axial component which increases the force and the movement, leading to complete failure. (Figs. 3 and 4).

In larger transformers the mechanical forces involved can amount to thousands of pounds. Therefore in Round-Wound transformers we pay special attention to providing a mechanical structure sufficiently strong to support and hold the coils in position in the assembly.

This structure requires a rigid steel frame, firmly tied together vertically (Fig. 5), and properly designed blocking (Fig. 6). Even leads must be strongly clamped (Fig. 7), since great mechanical forces may exist between adjacent leads.

Varnish Selection

Correct application of the proper varnish provides a bond between layers of insulating paper and coil sections which contributes to short-circuit strength. We have developed a variety of tests for varnish, including a mechanical test of bonding strength. (Fig. 8). These tests enable us to select those few varnishes which combine the highest mechanical and electrical strength with other desirable qualifications.

The overall result of design, construction, selection of materials, and careful manufacture has given L-M Round-Wounds unusually high short-circuit strength, which contributes to an extremely low rate of failure.

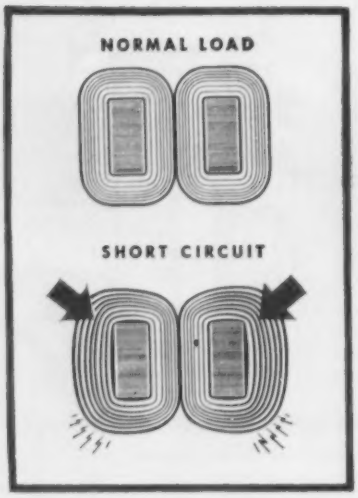


FIG. 1. Radial forces existing under short-circuit currents make rectangular coils tend to become round. The forces may be violent enough to damage insulation, or may completely destroy the coils.

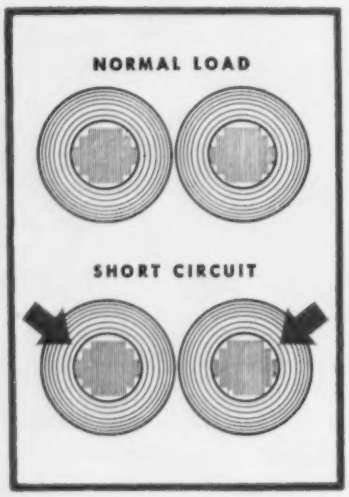


FIG. 2. Since the coils of Round-Wound transformers are already round, short-circuit radial forces cause no distortion. Thus Round-Wounds have inherently higher short-circuit strength.

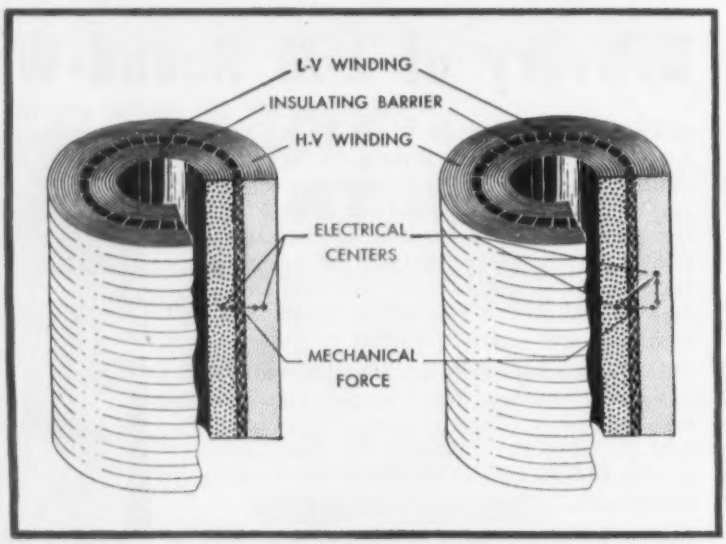


FIG. 3. Diagrammatic vertical section of coil showing primary and secondary electrical centers on the same horizontal plane. Under short circuits, all forces are radial and windings tend to repel each other in a horizontal plane. But even though coils can be designed with the electrical centers on the same plane, manufacturing tolerances cause some variations; and tap changer operations will cause some unbalance.

FIG. 4. With electrical centers displaced vertically, the force between the centers has both radial and axial (vertical) components. Axial forces cause the windings to telescope and separate vertically. Any displacement increases the vertical force component between them, which progressively compounds to complete destruction of the coils. The rigid construction of Round-Wound transformers prevents the slightest movement.

LINE MATERIAL Transformers

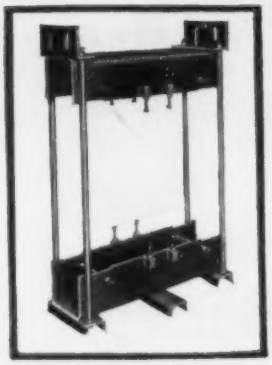


FIG. 5. Heavy steel frame provides a rugged mechanical structure that is firmly tied together vertically. It is sufficiently strong to support and hold coils in position in the assembly.

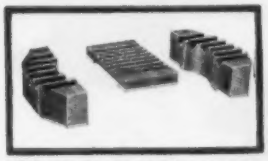


FIG. 6. Sturdy kiln-dried, oil-impregnated, shaped maple blocks give maximum contact and support to coil-edge surfaces. These are assembled and clamped so that they cannot move out of position under short-circuit forces.

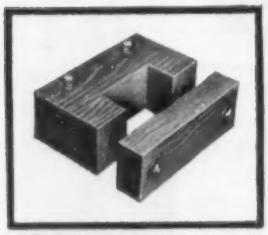


FIG. 7. Under short-circuit conditions, great mechanical forces exist between adjacent leads—especially in large transformers. These leads are strongly clamped so they cannot be harmfully displaced.

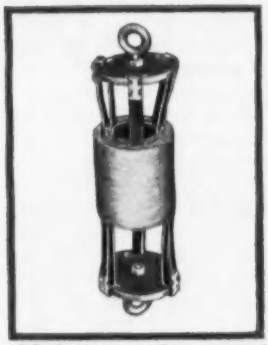


FIG. 8. Here is a coil impregnated with a test varnish set up for a pull test—which will determine whether the varnish has adequate bonding strength. This is just one of the tests L-M has developed to select the best varnishes for Round-Wound transformers.

"Round-Wound" is a Line Material Company trademark

Compare the Things That Count

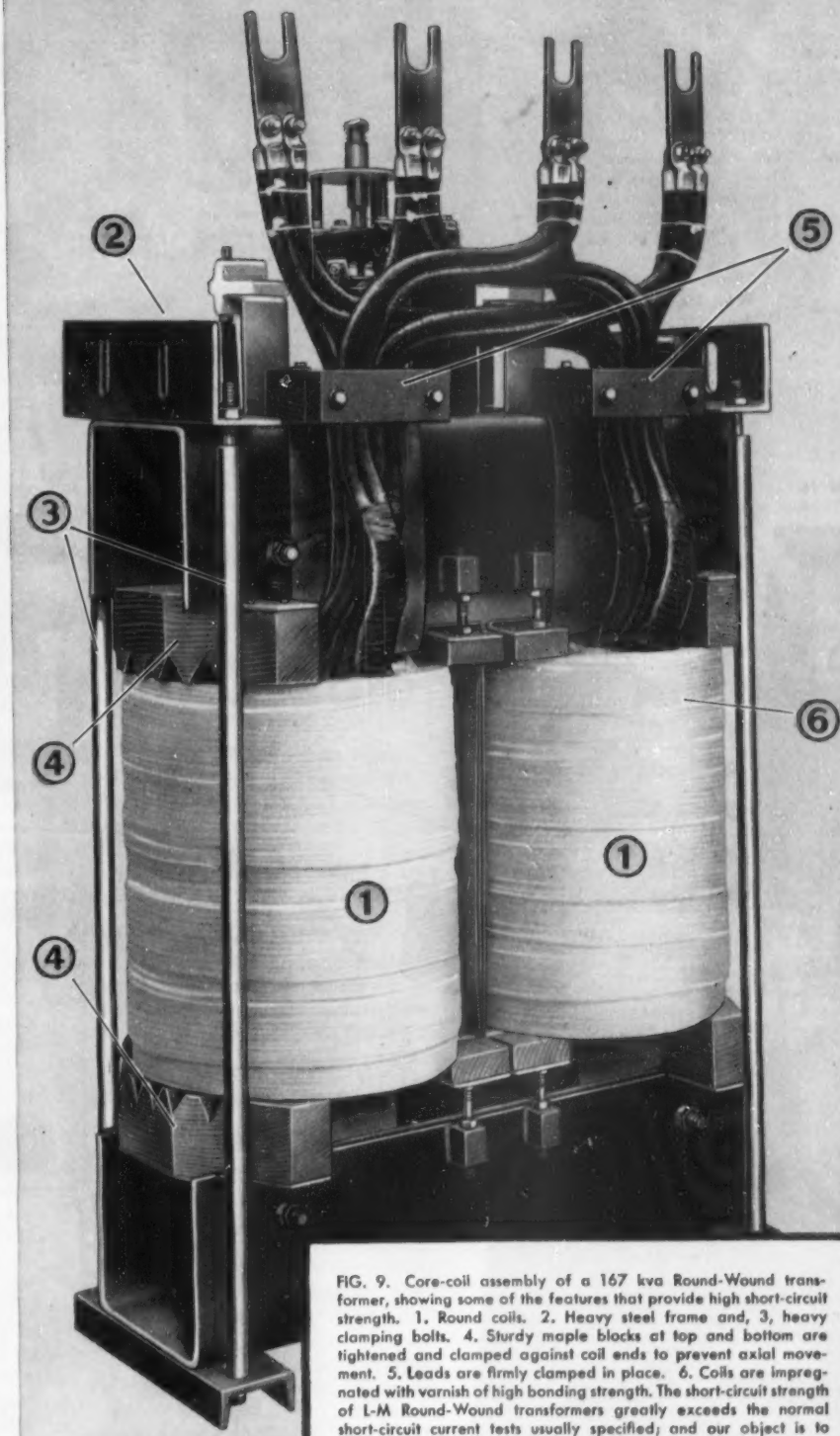
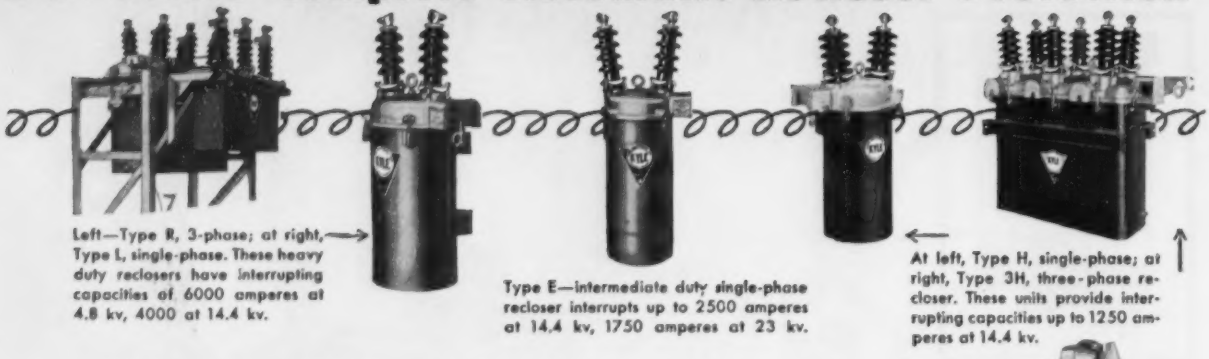


FIG. 9. Core-coil assembly of a 167 kva Round-Wound transformer, showing some of the features that provide high short-circuit strength. 1. Round coils. 2. Heavy steel frame and, 3, heavy clamping bolts. 4. Sturdy maple blocks at top and bottom are tightened and clamped against coil ends to prevent axial movement. 5. Leads are firmly clamped in place. 6. Coils are impregnated with varnish of high bonding strength. The short-circuit strength of L-M Round-Wound transformers greatly exceeds the normal short-circuit current tests usually specified; and our object is to build transformers that will withstand *dead* short-circuit currents.

Get Complete Information About L-M Round-Wound Transformers

We'd appreciate an opportunity to give you full information about the many desirable characteristics of these outstanding transformers. We'd like you to compare them with others—"Compare the things that count!" Ask the L-M Field Engineer for information; or write for new Bulletin DT-1 to Line Material Co., Transformer Div., Zanesville, Ohio (a McGraw Electric Company Division).

L-M Offers Complete Automatic Recloser Protection

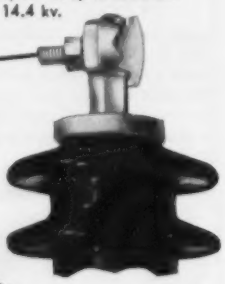


Left—Type R, 3-phase; at right, Type L, single-phase. These heavy duty reclosers have interrupting capacities of 6000 amperes at 4.8 kv, 4000 at 14.4 kv.

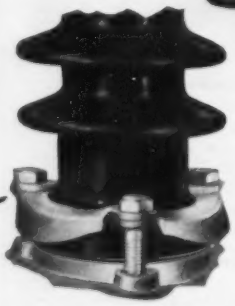
Type E—intermediate duty single-phase recloser interrupts up to 2500 amperes at 14.4 kv, 1750 amperes at 23 kv.

At left, Type H, single-phase; at right, Type 3H, three-phase recloser. These units provide interrupting capacities up to 1250 amperes at 14.4 kv.

With the units shown in the illustrations above, Line Material provides complete, coordinated automatic protection from substation to load—for single-phase and three-phase lines. This complete protection helps maintain service continuity, and cuts service calls by eliminating fuse blowing by temporary faults.

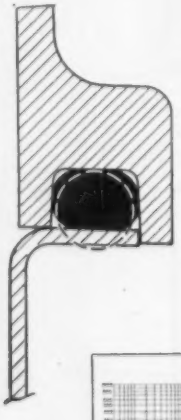


Plated universal terminals for copper or aluminum, No. 8 to 2/0. No loose parts to fall off.

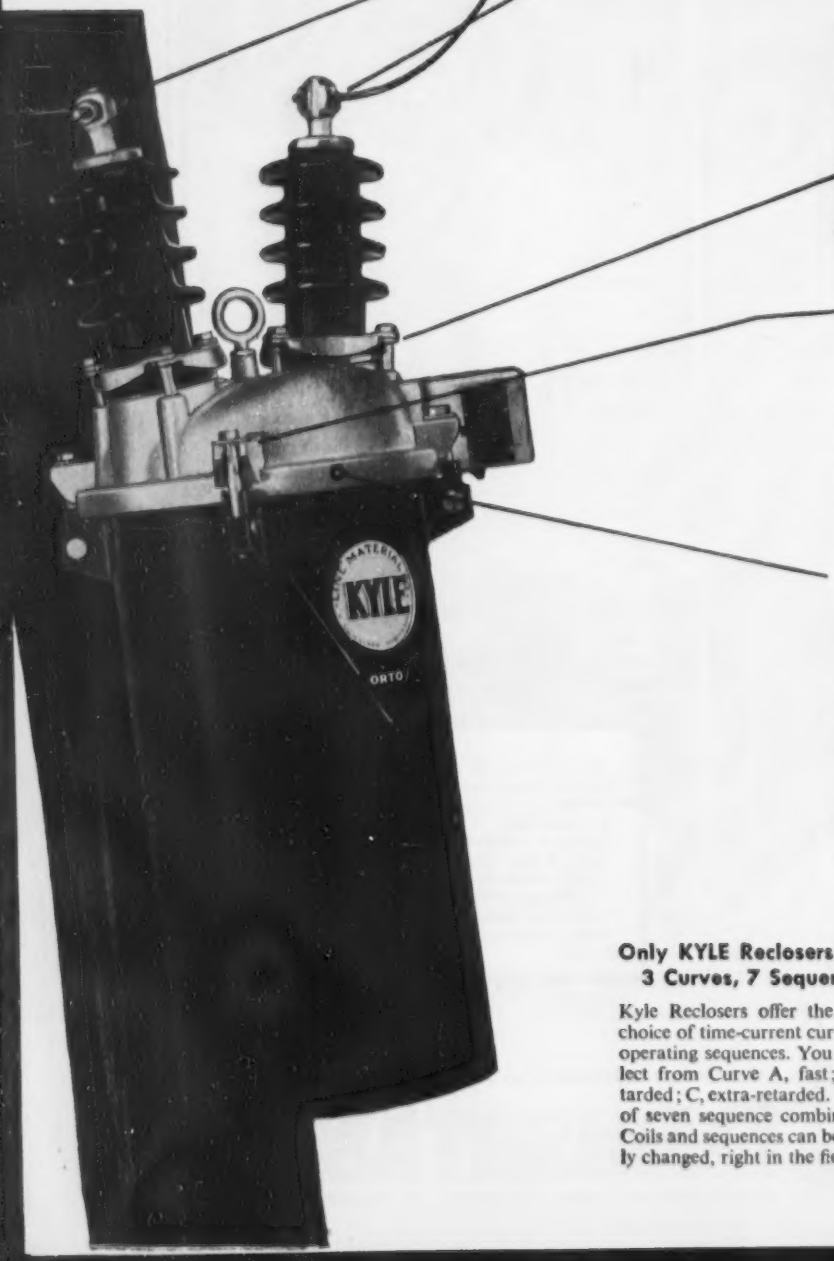


Clamp-on bushings, easy to replace in case of accident.

Head may be rotated to desired position.

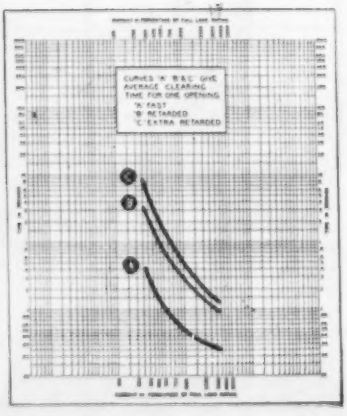


Soft O-ring type Buna-N oil-proof rubber gasket completely contained and held under proper pressure against tank rim by deep groove.



Only KYLE Reclosers Offer 3 Curves, 7 Sequences

Kyle Reclosers offer the widest choice of time-current curves and operating sequences. You can select from Curve A, fast; B, retarded; C, extra-retarded. Choice of seven sequence combinations. Coils and sequences can be quickly changed, right in the field.



The sleet hood is large, well proportioned. The counter has been improved. It has larger figures that are easier to read.

Optional non-reclosing device. With lever down, recloser opens once, does not reclose, for greater safety in hot-line work.

L-M's Kyle® Type H Reclosers Offer New Features For Greater Convenience

by **R. C. KIRK,**
Manager,
Kyle Products Sales,
Line Material Company

Perhaps one of the reasons for the wide leadership of Kyle Reclosers is the close attention we have always given to product performance *and* convenience for the operating man. In line with this policy, further improvements have been made in the Kyle Type H, the world's largest-selling oil circuit recloser.

New clamp type bushings are now being used. These make bushing replacement easy in case of accident. Universal terminals are plated for use with both copper and aluminum.

Tank cover clamping and gasketing have been improved to take full advantage of latest gasketing materials. The head is larger, smoothly contoured, with a large lifting eye. Gasket is now a soft O-ring of oil-proof Buna-N rubber, contained in a deep groove which keeps the gasket under controlled compression against the tank rim. Lips on the groove keep the gasket from falling out when head is raised.

The tank itself is slightly larger. Oil capacity has been increased to 4¼ gallons. This, plus the use of ORTO®, L-M's inhibited transformer oil, is extra oil-life insurance.

Sleet hood is larger. Figures on the counter are larger and more legible. The non-reclosing device, shown above, is now available as optional equipment.

Interrupting ratings have been rounded off so that they are all 25 times the coil size. This represents no appreciable change, as there is still a very large margin of safety in Kyle design.

Advantages of Recloser Operation

The use of Kyle Automatic Reclosers helps maintain continuity of service, because the recloser eliminates a large majority of the faults that blow fuses. This cuts service trips, and eliminates the risk of upsetting coordination by installing the wrong size fuse.

Kyle Reclosers themselves offer many advantages. Their operation is accurate and dependable, in all kinds of weather. Kyles provide positive toggle action, fast opening and closing. They do not depend on gravity, motors, or clockwork. Kyles offer a wide choice of time-current curves and operating sequences. Coils and sequences are easily changed, right in the field!

The Kyle hydraulic mechanism is simple, troublefree. Thousands of Kyles are in regular operation from the tropics to Alaska. More than 100,000 Kyle Type H Reclosers prove the value and dependability of the Kyle operating principles.

Ratings of Kyle Type H Reclosers

Coil Rating, Amperes	Minimum Tripping Current, Amperes	Interrupting Ratings,* Amperes, 14.4 kv
5	10	125
10	20	250
15	30	375
25	50	625
35	70	875
50	100	1250

*Symmetrical RMS Amperes at maximum phase to phase nominal voltage of 14.4 kv. Interrupting ratings are based on a maximum test circuit X/R ratio of not less than 8 and the asymmetrical rating in total RMS amperes is 1.4 times the symmetrical ratings given in the table.

Get Information on Complete Coordinated Automatic Protection

L-M offers a complete line of reclosers and sectionalizers to provide complete, coordinated protection—single- and three-phase—from substation to load.

Ask the L-M Field Engineer for information and bulletins on Kyle apparatus—or write Mr. Kirk at Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division). 161

LINE MATERIAL
Kyle® Reclosers

"Neglect commercial cooking load today, and you can lose $1,000,000 in extra revenue tomorrow."

"In 1952, and again in 1953, our company—Appalachian Electric Power Company—added approximately 14,000 KW of new commercial cooking load to our lines in Virginia and West Virginia.

"This represents business that we would not have gotten without a full-scale commercial cooking promotion program. As a matter of fact, this business might have been lost to us for years without aggressive action on our part. Because of its very desirable characteristics, competition is keen for the commercial cooking load, and only 'hard selling' has made possible the capture of a substantial part of this market for our service.

"Our discovery of the importance of the commercial cooking market is not new. In certain other utilities, such as Union Electric, Pennsylvania Power & Light and West Penn, this business is already near or above the million dollar mark.

"Promotion of commercial cooking presents a unique opportunity. Though the business is highly competitive, because of the inherent advantages of electric cooking it can be successfully promoted to bring a substantial return for a relatively small investment. Not only does the commercial cooking load represent good business for the utility, but it presents very large benefits to the giant food-service industry.

"This business opportunity can best be realized through planned, year-around commercial cooking sales activity."

—Julius Hall, Jr., *Commercial Manager*, Appalachian Electric Power Company

Here's the 8-POINT SUCCESS FORMULA used and recommended by utilities that have made a big business of Commercial Cooking:

1 Top management's enthusiastic support, interest and cooperation.
2 Trained, incentivized supervisors backed by sufficient field specialist man-hours.
3 A financial investment in proportion to the market's profit potential.
4 A *year-around* commercial cooking program. (Facts prove part-time programs wasteful, as sales from a once-a-year "push" never offset the hundreds lost to competition during inactive months.)
5 A *3-month* "maximum effort" special campaign on commercial cooking.
6 Special promotion activity, using Hotpoint's successful programs for operator group meetings, plus free-trial installations, etc.
7 Complete kitchen layout service.
8 24-hour service, plus availability of "loaner" equipment to prevent temporary shutdowns.

★ ★ ★

Want to share our commercial cooking facilities and programs? Write, and I will give your letter my personal attention.

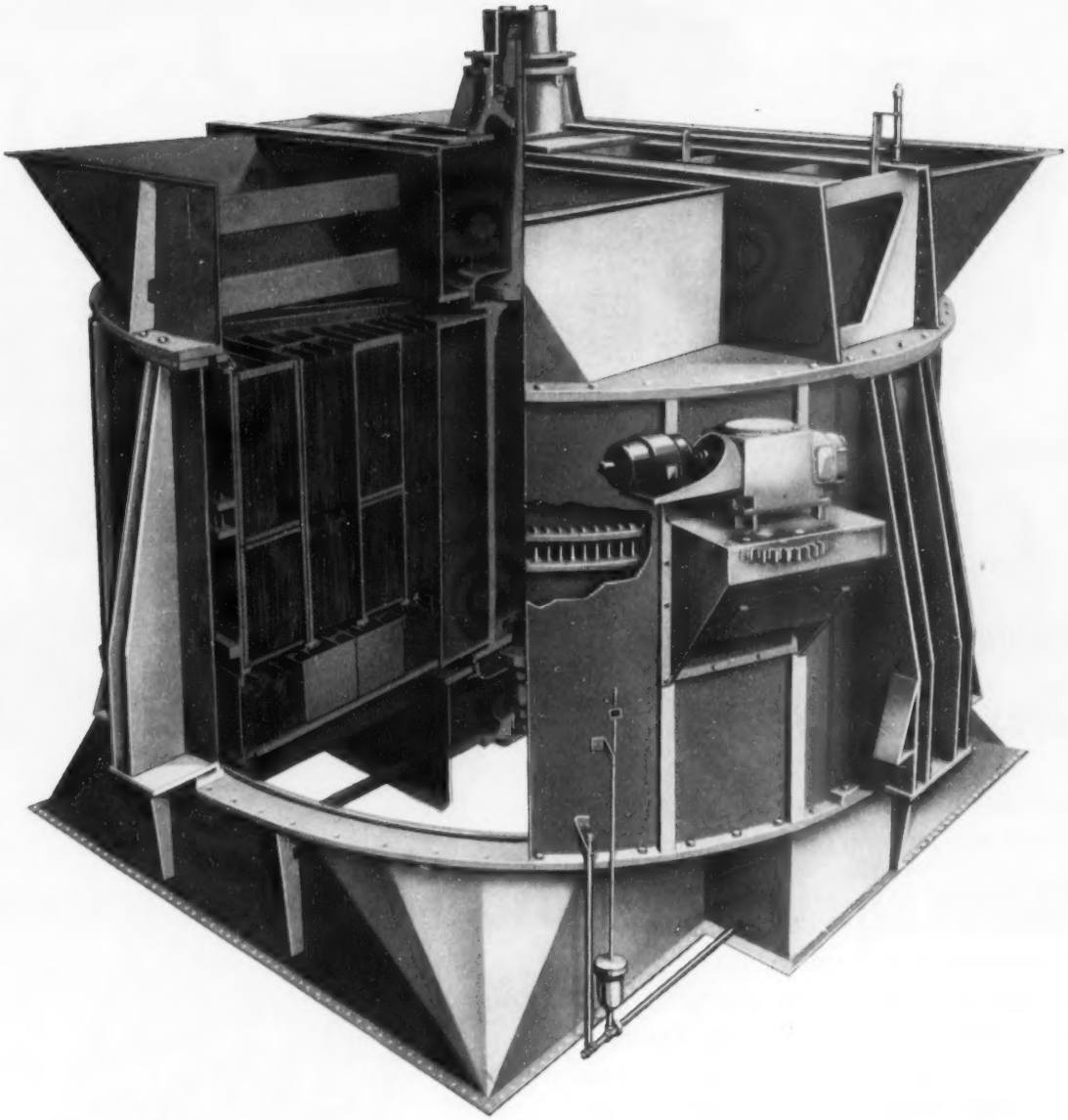
Orrin E. Wolf

Orrin E. Wolf, Vice President, Hotpoint Co.

Hotpoint ALL ELECTRIC **Commercial Cooking Equipment**

Hotpoint Co. A division of General Electric Company

Commercial Equipment Department, 265 South Seeley Avenue, Chicago 12, Illinois



THE LJUNGSTROM AIR PREHEATER

cuts fuel costs in hundreds of plants

The Ljungstrom Air Preheater has proved its value in industrial and utility plants throughout the country. That's why every year, a constantly increasing percentage of the total installed boiler capacity is Ljungstrom-equipped. *Your fuel costs will drop, too,* when you equip your boilers with Ljungstroms. The extremely high efficiency of the regenerative design means the greatest possible recovery of waste heat . . . with substantially lower fuel requirements. If you are planning a new boiler installation – or expanding or modernizing your present one – let our engineers show you how the Ljungstrom can raise over-all efficiency in your plant. Ljungstrom Air Preheaters are now available for boilers of any type or capacity from 25,000 pounds of steam per hour up.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

CHASE

PIN-POINTING TROUBLE BEFORE IT STARTS!

By expanding Antimonial Admiralty Condenser Tubes over a tapered pin in the laboratory, Chase metallurgists check the ability of the tube to withstand expanding and flaring operations during installation.

Another reason why

Chase®

Antimonial Admiralty Condenser Tubes last longer!

For Condenser Tubes that stay on the job year in, year out, insist on Chase Antimonial Admiralty.

What's the secret? *Enough* antimony to resist dezincification effectively. Does antimony adversely affect the strength or other properties of admiralty? Definitely not! The antimony imparts corrosion resistance which assures long life under many different water conditions.

So, whether you're replacing condenser tubes, or planning a new installation, specify Chase Antimonial Admiralty!

PROMPT SHIPMENTS from our mills in Cleveland and Waterbury.

Chase® BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany †	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver †	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester †	(† sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

Vacuum dried, oil impregnated crepe paper

NOW IN PRODUCTION AT IRVINGTON!

Your requirements for crepe paper insulation can now be supplied by Irvington — the *leader* in electrical insulation.

Crepe paper and oil are degasified under very high vacuum to assure freedom from moisture and provide good electrical properties.

The paper is packaged in cans to meet your specific requirements for number and size of rolls. Roll sizes include ½" x 4 yards, 1" x 4 yards, 1" x 18 yards, 1" x 36 yards. Cotton yarn and copper mesh can also be included.

Use Irvington Crepe Paper on your low- and medium-pressure gas-filled cable — and also on oil-filled and pipe-type cable.

Look to
IRVINGTON
for Insulation Leadership

INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

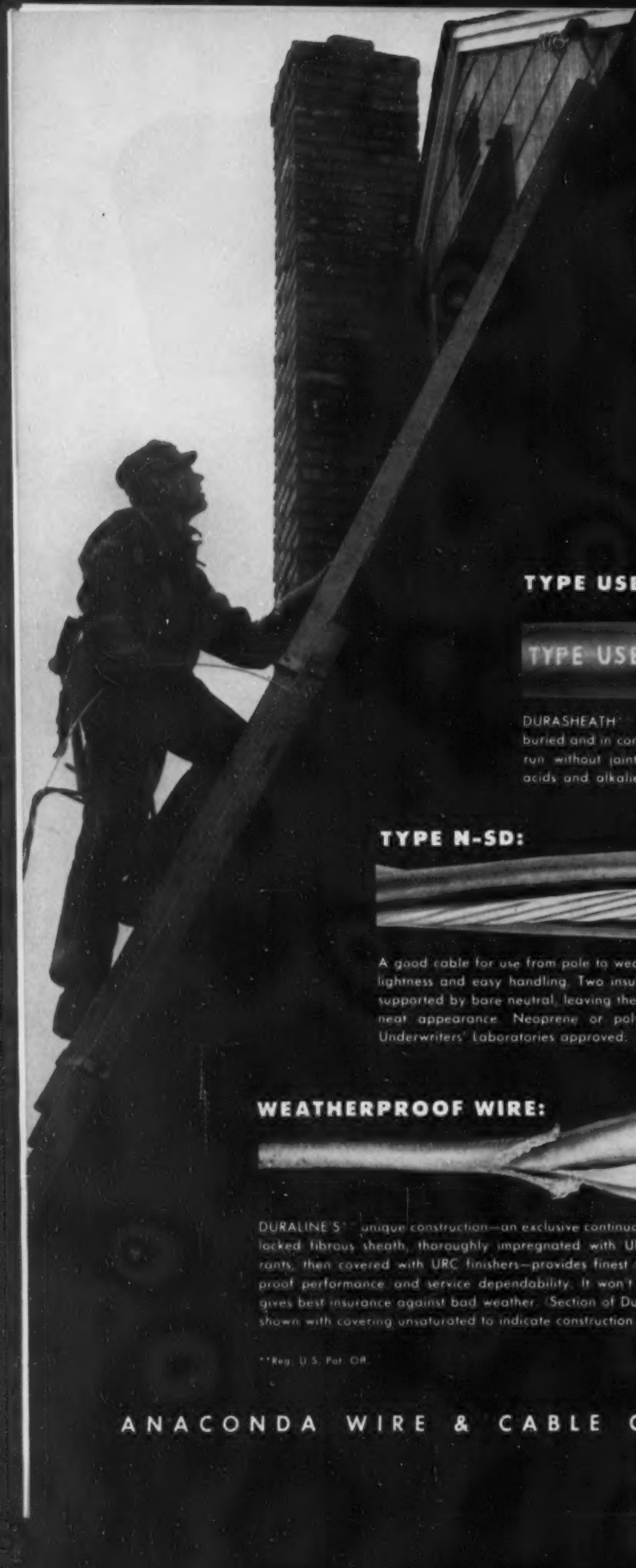
Other IRVINGTON Insulations for Utilities

Harvel Oil Stop 621 • Fibron® Plastic Tape • Temflex® 105 Tape • No. 32 Red Enamel

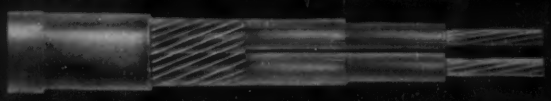
IRVINGTON VARNISH & INSULATOR

DIVISION OF MINNESOTA MINING & MANUFACTURING COMPANY

21 ARGYLE TERRACE, IRVINGTON 11, N. J. • PLANTS: IRVINGTON, N. J.; MONROVIA, CALIF.; HAMILTON, ONTARIO, CANADA



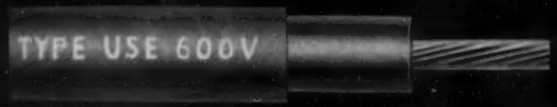
TYPE SD:



This practical cable is moderately priced for use from pole to weatherhead . . . and from weatherhead to meter if in conduit. URC saturated and finished. Weather-resistant outer braid. Can be painted after installation without discoloration of the paint. Underwriters' Laboratories approved.

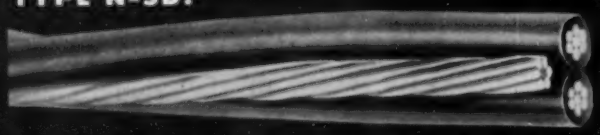
TODAY'S

TYPE USE:



DURASHEATH** Type USE may be installed aerially, directly buried and in conduit—from pole top to meter—in one continuous run without jointing. Neoprene jacket resists sunlight, oils, soil acids and alkalies. Underwriters' Laboratories approved.

TYPE N-SD:



A good cable for use from pole to weatherhead. Linemen like its lightness and easy handling. Two insulated conductors are *fully* supported by bare neutral, leaving them free of tension. Presents neat appearance. Neoprene or polyethylene insulation. Not Underwriters' Laboratories approved.

WEATHERPROOF WIRE:

DURALINE'S** unique construction—an exclusive continuous interlocked fibrous sheath, thoroughly impregnated with URC saturants, then covered with URC finishers—provides finest weatherproof performance and service dependability. It won't festoon, gives best insurance against bad weather. (Section of Duraline is shown with covering unsaturated to indicate construction clearly.)

**Reg. U.S. Pat. Off.

ANACONDA WIRE & CABLE COMPANY, 25 BROADWAY,

TYPE SE:

SILVALINE*—the aristocrat of service cables—may be run from pole to weatherhead and without conduit to meter and fuse box and to such appliances as ranges, water heaters, etc. URC saturated and finished. Smooth outer braid coated with silvery paint for a superior finish. Can be painted after installation without discoloration of the paint. Underwriters' Laboratories approved.

*Trade Mark.

HEADQUARTERS FOR SERVICE CABLE

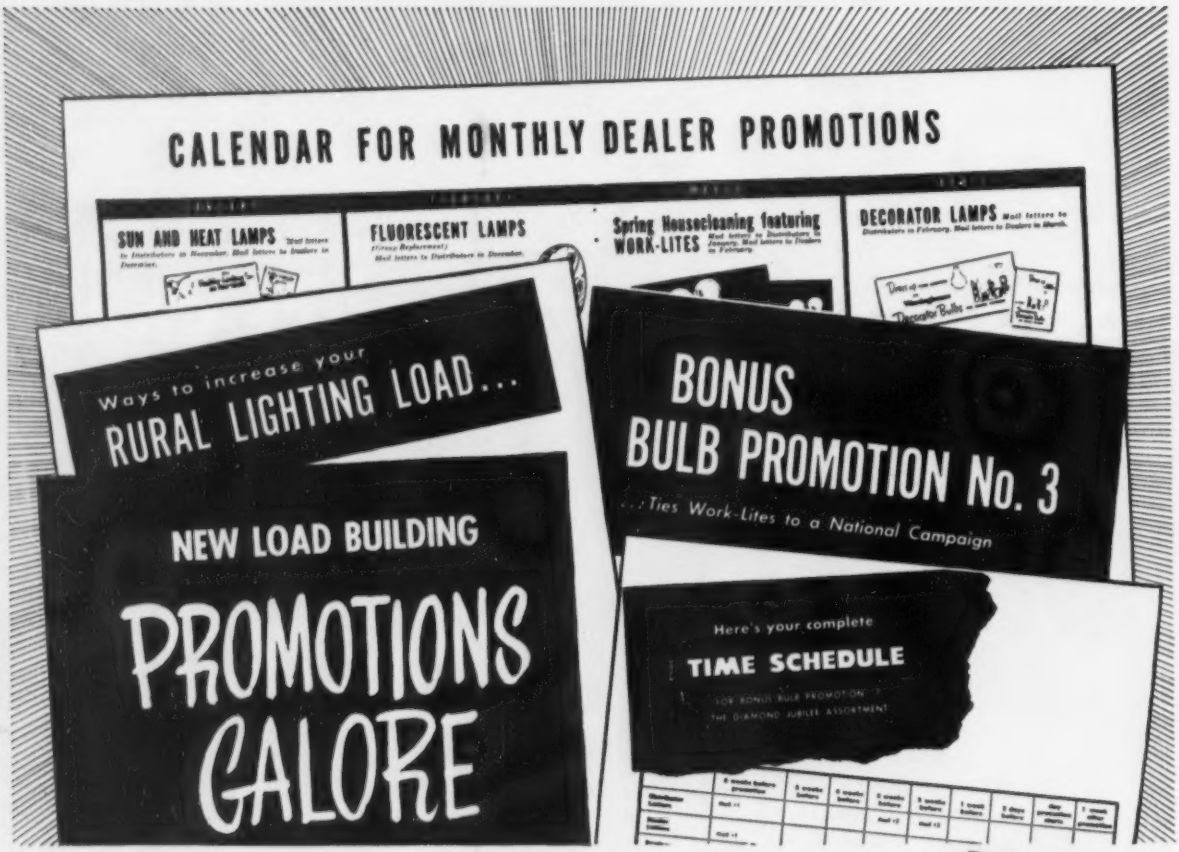
ANACONDA

service and overhead distribution cables, bare and weatherproof, including ACSR • signal, control and communication wire • portable cords and cables • network cables • airport and street lighting cables • mine cables • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories

● *All AnacondA Service Cables are available with copper or aluminum conductors. Ask your Anaconda Sales Office for complete information.*

NEW YORK 4, N. Y.

11 ways to build load during Light's Diamond Jubilee



Use this Free 28-page Westinghouse booklet to build year-round load

You'll find this new booklet a veritable "encyclopedia" of load building promotions. The plans outlined are completely flexible, and can be tailored to your specific needs. Here's a glimpse of the contents:

- Bonus Bulb Promotion No. 1
- Bonus Bulb Promotion No. 2
- Bonus Bulb Promotion No. 3
- Display Contest
- Mystery Shopper Promotion
- Employee Contests
- Monthly Dealer Promotions
- Ways to Increase your Rural Load
- Materials for Meetings
- Films Available for Meetings
- Industrial and Commercial Material

To get your copy without cost or obligation, contact your Westinghouse Lamp Representative or write directly to Westinghouse Lamp Division, Dept. EW-2, Bloomfield, New Jersey.

YOU CAN BE SURE...IF IT'S

Westinghouse

Roeplastic control cable—

THE ONLY CONTROL CABLE WITH CIRCUITS

POSITIVELY

IDENTIFIED

THIS NEW Roebling ROEPLASTIC Control Cable makes circuit identification quick and certain for the first time in history. A workman can't go wrong even if he's color blind. Here's why:

In ROEPLASTIC Control Cable, each conductor is identified from end to end by both its IPCEA code color name and its individual number by means of an indelible printing against a strongly contrasting background. The printing is permanent; it cannot fade or rub off... identification is always positive whether plans show circuits by color code or by numerals.

Roebling ROEPLASTIC Control and Signal Cables are ideal for such purposes as remote control of motors, switch gear, automatic machinery, etc.... for traffic light control, relay, metering and supervisory circuits. They are made in constructions, types of insulations and over-all sheaths to meet every specific requirement. Write for technical data... and order ROEPLASTIC Control and Signal Cables from your Roebling distributor. John A. Roebling's Sons Corporation, Trenton 2, N. J.

Subsidiary of The Colorado Fuel and Iron Corporation

ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13228 LAKEWOOD HEIGHTS BLVD • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG • HOUSTON, 8215 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1930 E. 2ND ST • PHILADELPHIA, 230 VINE ST • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 32 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

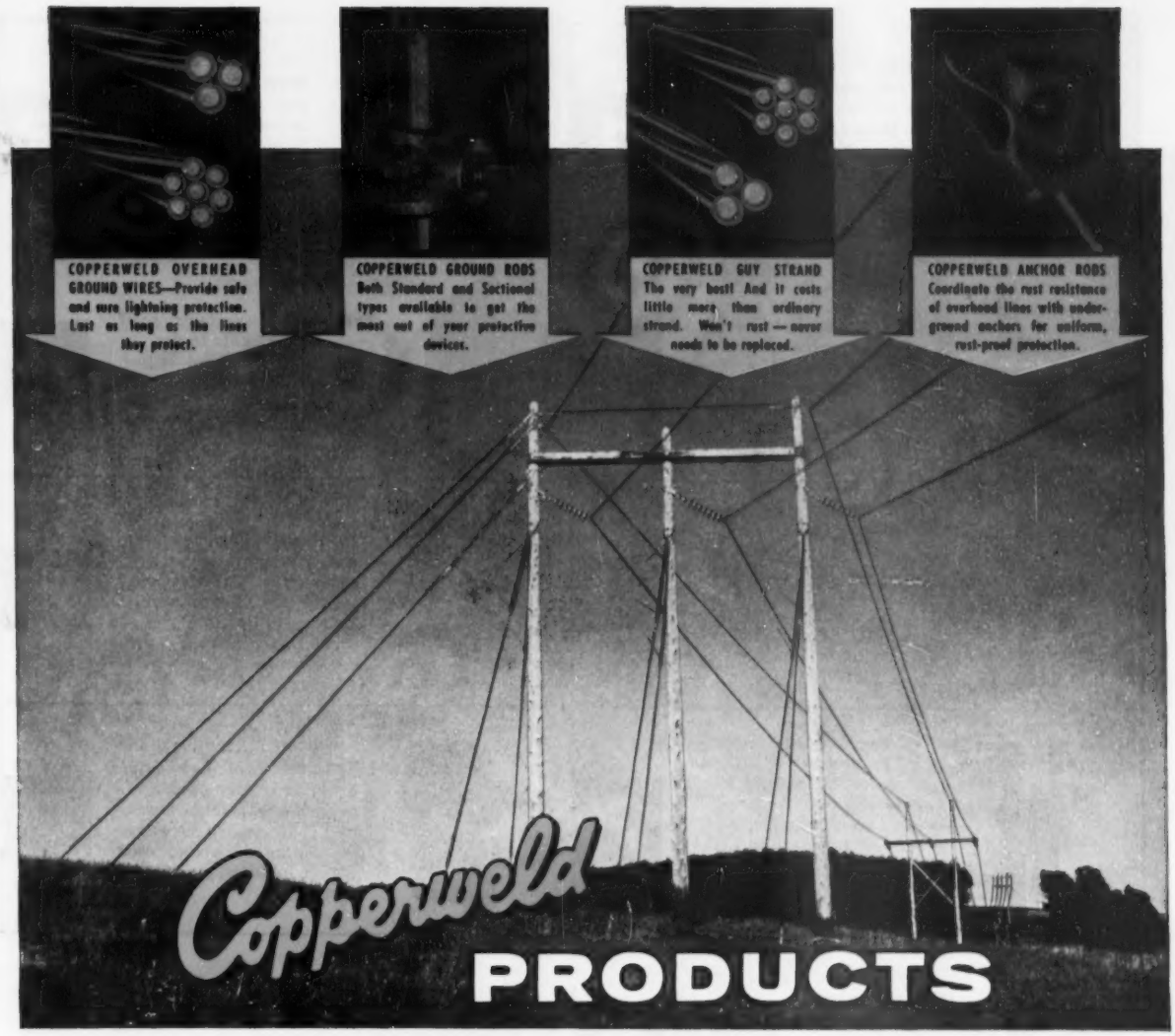
CF&I

Once it gets a foothold, fire rips into your plant like a monstrous claw. That means you must guard every hazard– flammable liquids, electrical equipment as well as ordinary combustibles– with Kidde Portable Extinguishers or Built-in Systems. Call your Kidde agent today.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc. and its associated companies.

Kidde

Walter Kidde & Company, Inc.
230 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.


COPPERWELD OVERHEAD GROUND WIRES—Provide safe and sure lightning protection. Last as long as the lines they protect.
COPPERWELD GROUND RODS Both Standard and Sectional types available to get the most out of your protective devices.
COPPERWELD GUY STRAND The very best! And it costs little more than ordinary strand. Won't rust — never needs to be replaced.
COPPERWELD ANCHOR RODS Coordinate the rust resistance of overhead lines with underground anchors for uniform, rust-proof protection.
Copperweld
PRODUCTS

For GROUNDING and GUYING

UNEQUALED in performance! UNRIVALED in long life! UNSURPASSED in economy!

Good engineering goes hand in hand with the best materials, especially for grounding and guying. That's why so many power systems, railroads and communication companies buy Copperweld* Products. There is no better way to keep overhead down and to be assured of constant, uninterrupted service. Use Copperweld Products on all your installations—it pays!

*Trade Mark

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION Glassport, Pa.

SALES OFFICES IN PRINCIPAL CITIES

For Export: Copperweld Steel International Company, New York

Good Engineering Demands The Best Materials... Copperweld PRODUCTS

Combine the strength of steel with the conductivity and permanence of copper.

TYPE GA-H—*Grounds wide range of standard 'H' beam posts to fence fabric and cable. Range of cables parallel to post easily accommodated. Also available for grounding more than one cable. One-wrench installation.*

1

TYPE GD—*Connects a pair of equal cables or single looped cable to pipe or column. Wide range of cable sizes.*

2

TYPE GX—*Provides a rapid means of connecting crossed cables. Easy to install and inspect. Takes wide range.*

3

TYPE GB—*Connects range of ground lead cable to flat structural or equipment surfaces. One-wrench installation.*

4

TYPE GP—*Clamp-type ground connector for joining parallel cables at right angle to ground rod, pipe, or column. Range of cable sizes in either groove.*

5

TYPE GAR—*For connecting wide range of ground cable either parallel or at right angles to rod or pipe. Easily installed by tightening two nuts on U-bolt.*

6

TYPE GK—*Connects three equal ground cables clamped parallel to the rod or pipe. Frequently used to join grounding conductor, grounded member, and looped ground bus at one point. Accommodates wide range.*

7

TYPE GG—*Joins flat flexible braid or copper bar to ground pipes, fence posts, and columns. Effective for grounding operating rods, switch handles, gate posts.*

8

TYPE YA (HYLUG)—*Compression connector for terminating ground cable to flat surface. Easily, economically installed with Burndy Hypress.*

9

sound solutions to the problem of

GROUNDING

Engineered to the same precise standards as connectors that carry continuous current loads . . . Burndy grounding connectors can be depended on to provide permanent protection against

• ARC-OVERS • ELECTRICAL LEAKAGE
• LIGHTNING • DIRECT SHORT CIRCUITS

These nine designs are available in 30 variations for connection to driven rod, pipe, cable, fence post, structures, lamp standards.

Send for the Burndy Grounding Catalog, which offers an interesting technical discussion on approved techniques, methods, and materials for proper grounding.

BURNDY

NORWALK, CONNECT. FACTORIES: NEW YORK, CALIFORNIA, TORONTO **TORONTO, CANADA** 54-1
EXPORT: PHILIPS EXPORT CORPORATION

Prepared for trouble?

You don't have to be armed to the teeth to avoid communications trouble. Not when your communications are supplied by the Bell System.

A planned program of preventive maintenance is an important part of Bell System service. Its purpose is to prevent interruptions in service.

In the laboratory, technicians are continually developing new and more efficient equipment. In the field, Long Lines plant and commercial experts frequently visit critical points of your communications system to observe conditions and to improve operations.

Alternate routings are an integral part of planning by telephone engineers to protect your service.

The entire program is backed by the Bell System's 78 years of communications experience.

We supply the power industry with reliable private-line telephone, mobile telephone and teletypewriter service, and channels for remote metering and supervisory control.

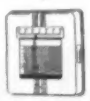
. . .

Your Bell Telephone Company will be glad to study your communications problems and needs.

PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE


METERING CHANNELS

BELL TELEPHONE SYSTEM

Wherever corrosion is a problem New G-E White Conduit is your answer

INDUSTRIAL FUMES
When subjected to 42 days in ammonium hydroxide and to 150 hours in sulfuric acid, the new G-E White demonstrated excellent corrosion-resistant qualities.
ACID VAPORS
Conduit samples were tested for 150 hours in hydrochloric acid, as well as 150 hours in sulfuric acid, proving G-E White's unsurpassed resistance to chemical fumes.
HEAT AND HUMIDITY
An extreme test of 42 days in 100% humidity at 105° F indicated G-E White conduit to be very suitable for warm, moist locations.
SALT SPRAY
Results of 1000 hours in a 20% solution of salt spray at 95° F showed that G-E White conduit is ideal for salt water atmospheres.
G-E WHITE

Six months of grueling laboratory and field tests show that a G-E White rigid steel conduit installation offers improved corrosion-resistance. This improved protection is a result of the metallizing process used for zinc galvanizing on G-E White. Metallizing bonds a controlled, non-flaking coating of zinc to the entire exterior of the conduit — threads and all. The inside is protected, too, by a special organic coating that produces a smooth, stable surface. G-E White conduit is listed by Underwriters' Laboratories, Inc., meets Federal Specification WW-C-581b.

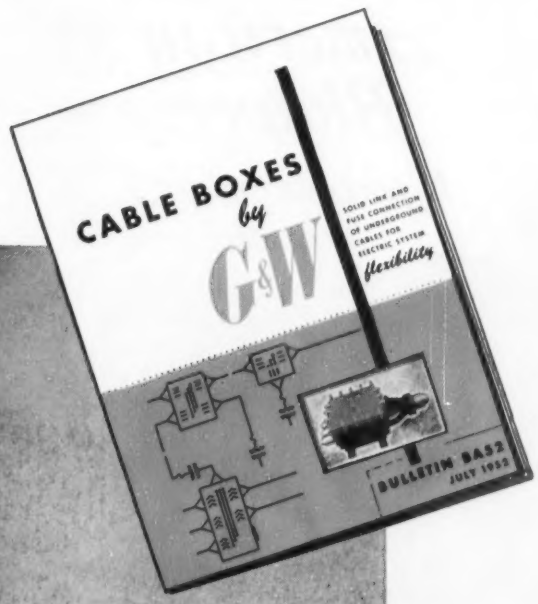
Contractors and maintenance men like the many features, such as easy bending and wire-pulling, that speed installation. For more information write Section C44-227, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

You can put your confidence in—

GENERAL ELECTRIC

CONSULT G&W FOR CABLE BOXES

Practical and economical standard and special designs for splicing, interconnecting or sectionalizing cables with solid, bolted, link or fuse connections.



Send for your copy of new Bulletin BA52

CABLE BOXES

Underground cable boxes are an important item in an electrical distribution system. They establish the desirable control over the duration and the extent of service interruptions. The ideal system is one which provides maximum continuity of service at minimum overall cost. The increased use of electric light and power makes it extremely difficult to arrange for even brief outages for necessary system changes and additions. Sectionalizing boxes permit circuit detours without dropping important loads. Fuse boxes minimize the extent of cable trouble. Distribution boxes provide for proper system maintenance with the least service interruptions.

No. B523

G & W Electric Specialty Co.
7780 Dante Ave., Chicago 19, Ill. Date_____

Please send me a copy of new Bulletin BA52 on CABLE BOXES—

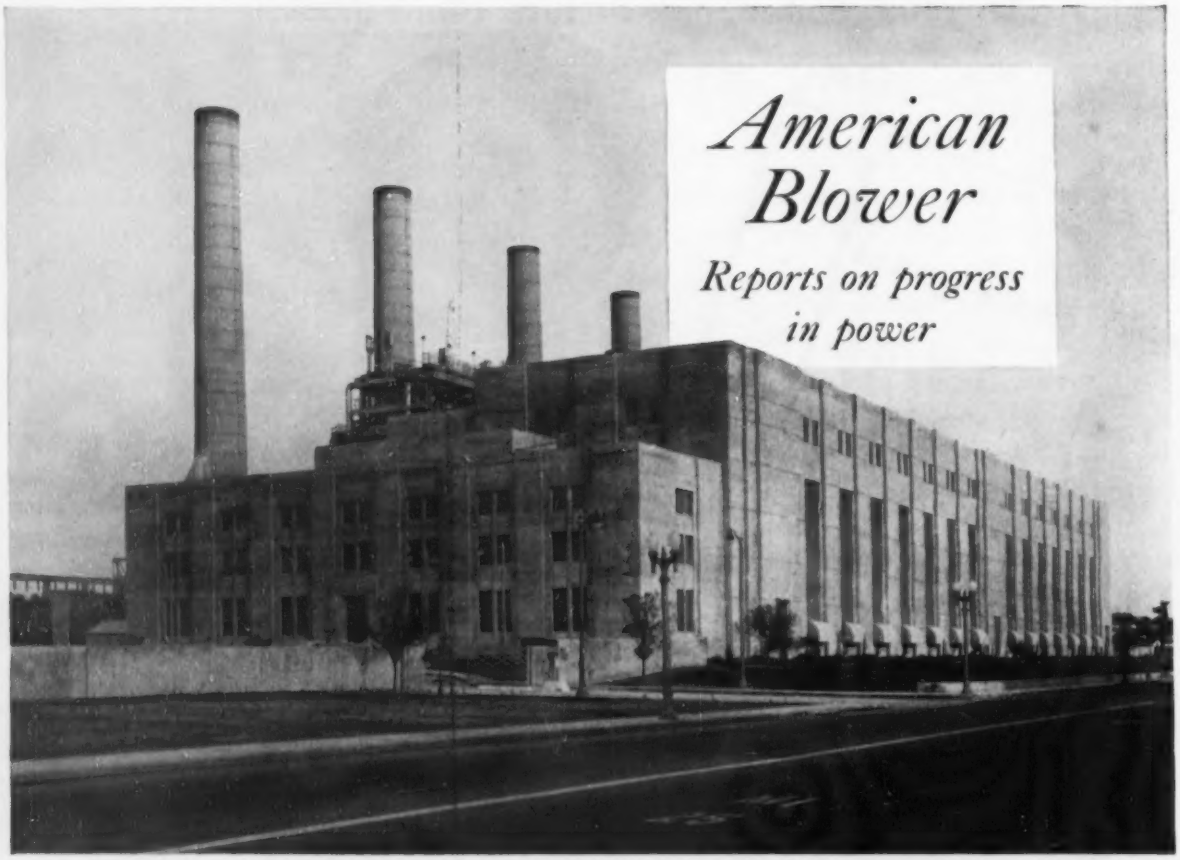
Name_____ Title_____

Company_____

Number, Street or P.O. Box_____

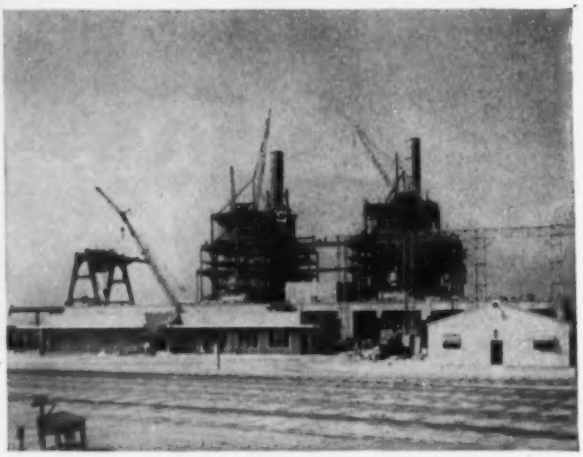
City_____ Zone____ State_____

So. Cal. Edison plans ahead with



Southern California Edison Company's Redondo Steam Station, completed in 1949, has a generating capacity of 288,000 kw.

Construction is now under way on Redondo Steam Station No. 2. When completed, it will have two 156,000 kw. generating units.



Etiwanda Steam Station has two generating units with a capacity of 250,000 kw. They went into operation in 1953.

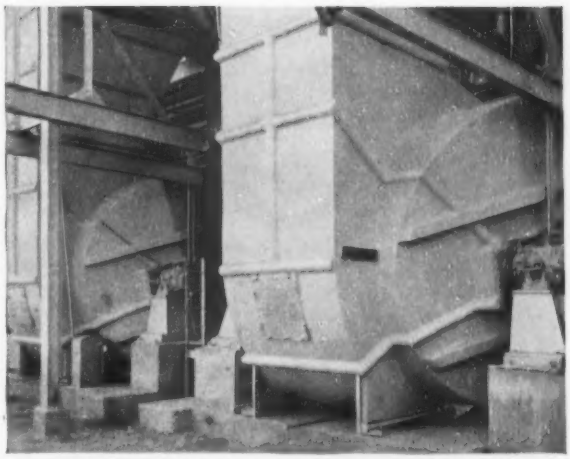
Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS &**

$490 million expansion program

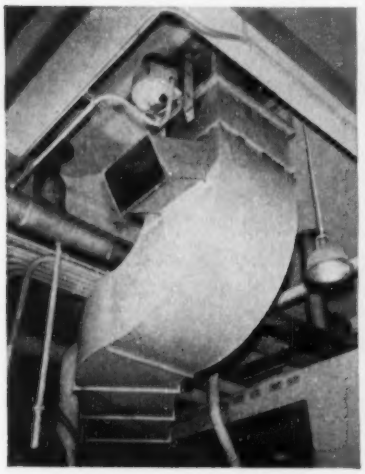
Keeping pace with the record growth of its service territory in Central and Southern California is a full time job for the Southern California Edison Company.

Since 1945, Southern California Edison has spent $490,000,000 for plant expansion alone. And the end is not yet in sight. When the first units at Redondo Steam Station No. 2 and the El Segundo Steam Station are completed, the Company will have a total generating capacity, both steam and hydroelectric, of a mighty 2,329,420 kilowatts.

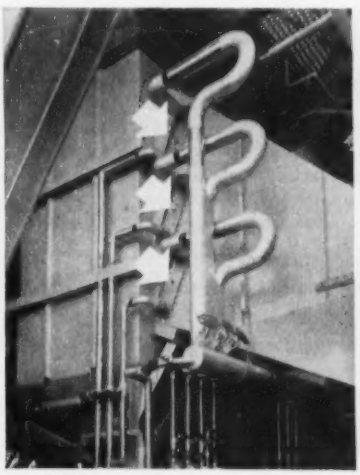
American Blower products played an important part in Southern California Edison's expansion plans. If you are planning to modernize or expand, let American Blower's wide experience work for you. Consult the nearest American Blower Branch Office or write us direct.



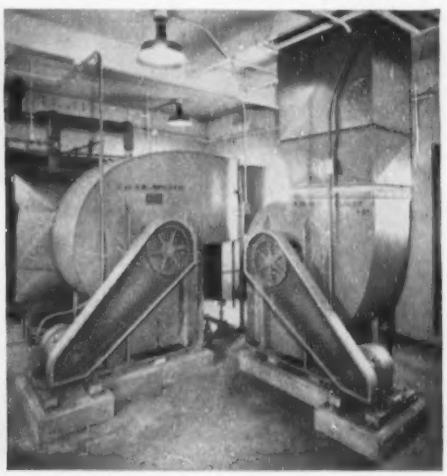
American Blower Induced Draft Fans are installed at Southern California Edison's Etiwanda Steam Station.



American Blower Tubeaxial Fan is designed to supply a wide range of volumes at medium pressures.



Southern California Edison's Etiwanda Station uses American Blower Heavy Duty Steam Coils (arrows).



Redondo Steam Station relies on American Blower HS Fans to efficiently supply and exhaust air throughout the entire building.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

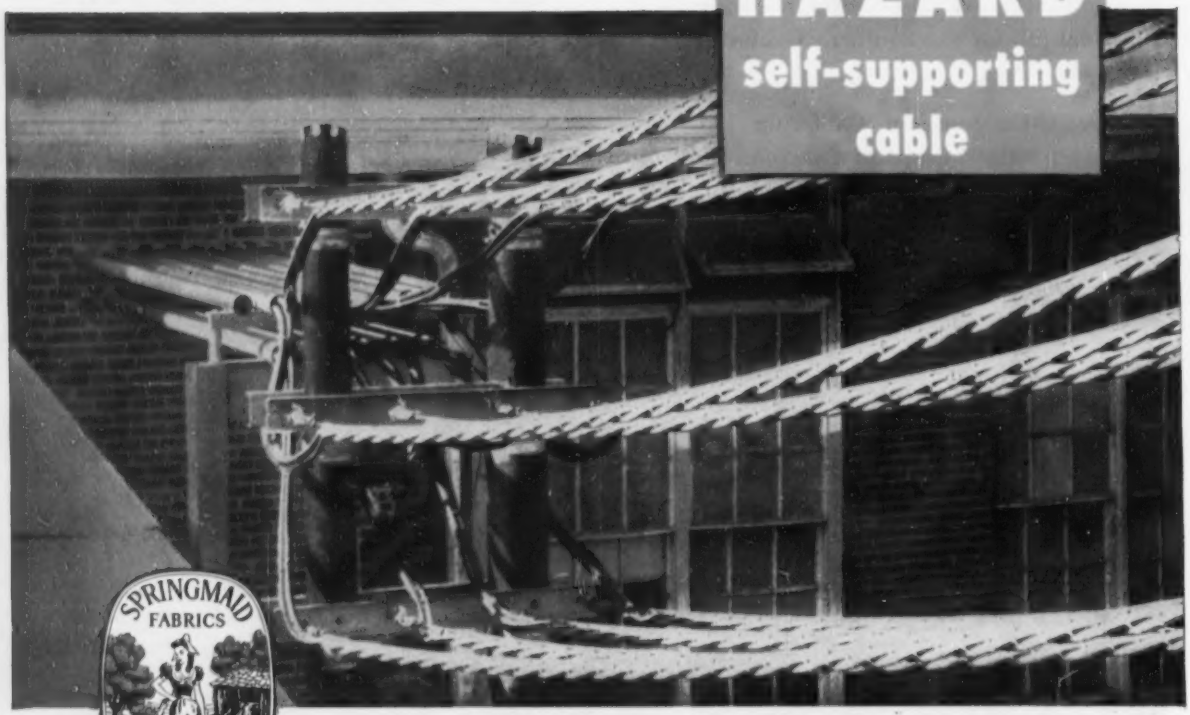
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

abreast of the trend
in industrial
power transmission

...SPRINGS MILLS
selects
HAZARD
self-supporting
cable



From main substation, Hazard self-supporting cables distribute power to the main buildings of Springs Mills plant. Note the neatness and compactness of the installation. Cables are readily accessible for splicing; all-in-one construction makes relocation easy.

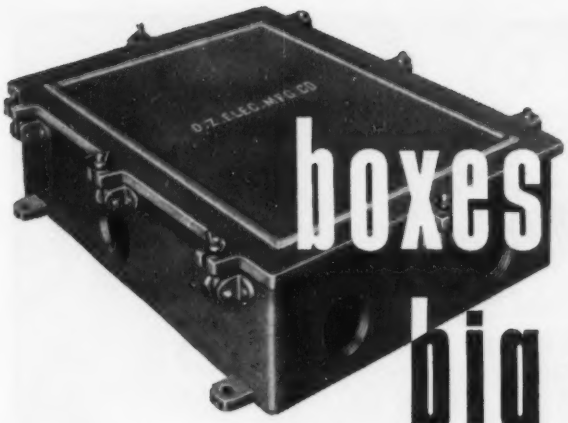
SPRINGS Cotton Mills, among the most modern in the textile industry and home of famous Springmaid fabrics, demand the finest when it comes to industrial power transmission. Safety, compactness, ease of installation, appearance and low cost were uppermost considerations in the selection of Hazard self-supporting cable for power distribution at the Springs Plant.

Hazard self-supporting cable is insulated with Watertite heat- and moisture-resistant insulation and protected by Hazard's rugged Hazaprene ZBF sheath. This abrasion-resistant jacket stands up against the destructive conditions common to industrial installations and, in addition, more than meets the requirements of the Federal Bureau of Mines and the Pennsylvania Department of Mines for flame resistance.

Every year, more and more Hazard self-supporting cable is used industrially for safe transmission of large blocks of power in limited spaces and narrow clearances, providing power distribution that is neat and compact and can be relocated with a minimum of effort. Today, investigate the advantages of the "all-in-one" construction (preassembled cable, messenger and binder) of Hazard self-supporting power cable for your particular operation. See your Hazard representative or write . . . Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

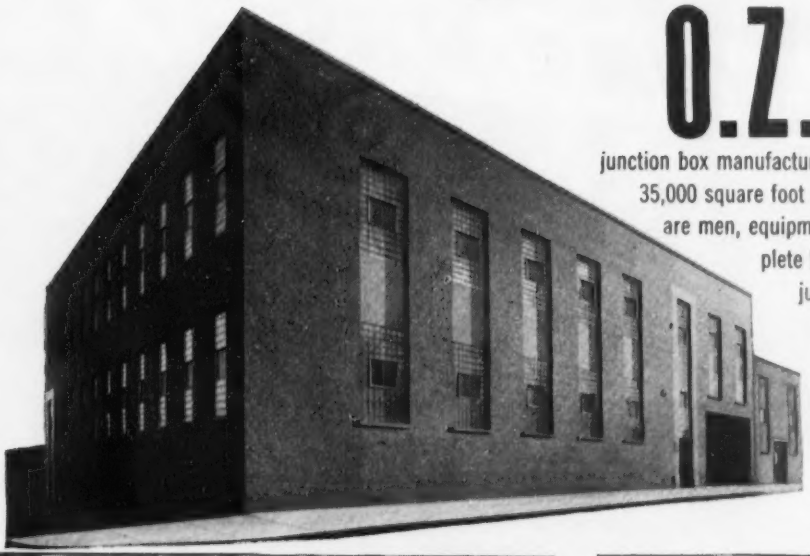
HAZARD *insulated cables*

1404



boxes are big business at O.Z....

So big, in fact, that our junction box manufacturing facilities are located in a new 35,000 square foot plant. Here, in a modern building, are men, equipment and space to fabricate a complete line of surface and flush-mounting junction boxes for every application and requirement. A large stock is maintained at all times for speedy delivery. Your O. Z. distributor is now in a better position than ever to fill your needs.



Modern equipment for fabricating junction boxes in this O. Z. box plant means greater efficiency for us . . . better service for you.

Greatly increased stock assures a constant supply of standard junction boxes and speedy processing of your orders.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 2, N. Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

IF IT'S ON THE PIN, IT'S IN SERVICE

THE DIFFICULTY of locating defective insulators is ended when your lines are protected with Kimble *Tempered* Glass Insulators.

Why? Because these new insulators are puncture-proof. Exhaustive laboratory tests at values far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air—*even under voltage impulses far above normal service rating.* Four years of field testing on more than 500 miles of line have produced no puncture failures. Even lightning surges have failed to damage these new Kimble *Tempered* Glass Insulators.

In the event of shattering due to severe mechanical shock, insulator disintegrates into small non-sharp fragments. Trouble shooters can locate broken insulator—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required.

* * *

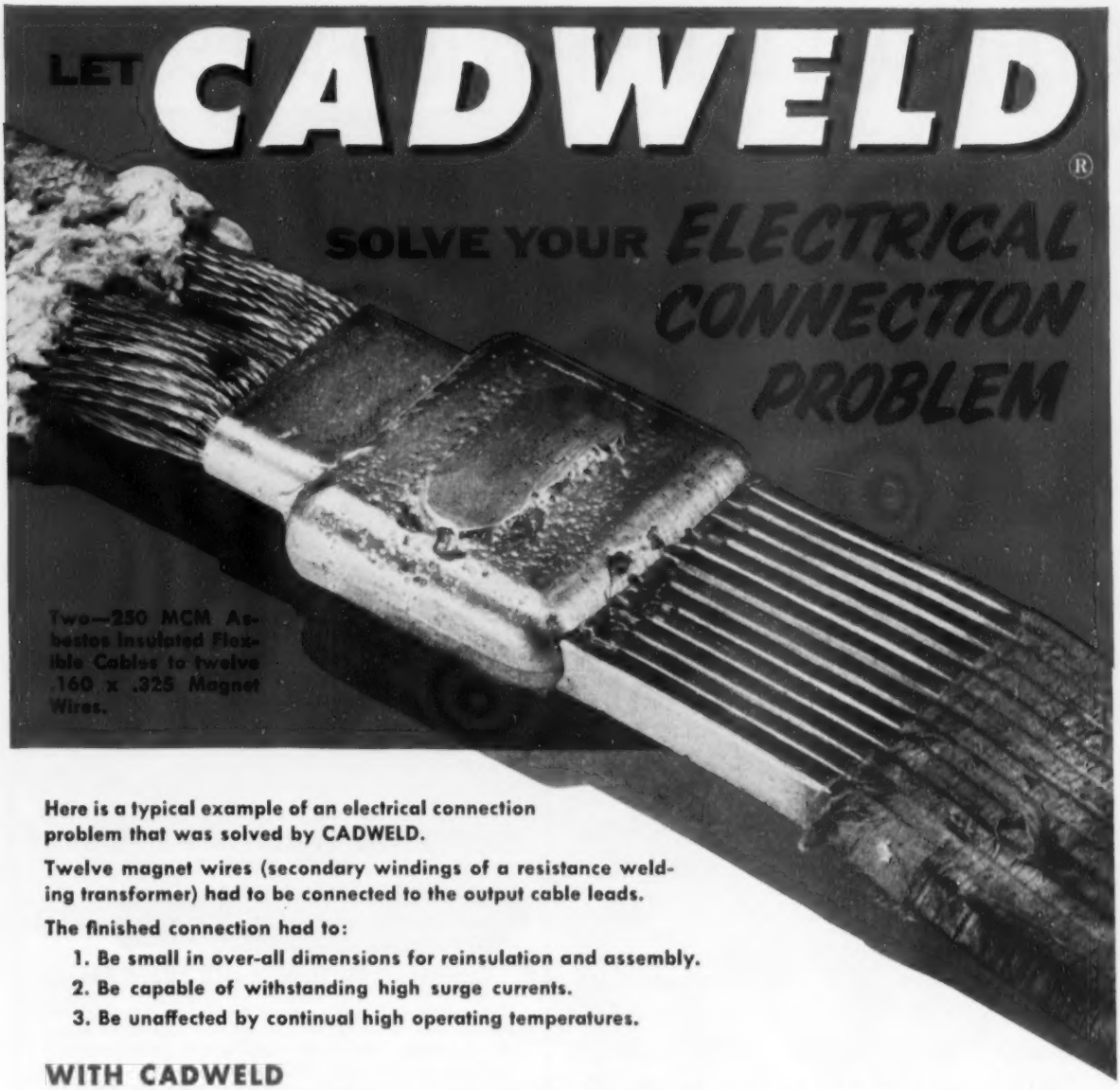
Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Insulator Division, Owens-Illinois, Dept. EW-2, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

LET CADWELD®

SOLVE YOUR ELECTRICAL CONNECTION PROBLEM



Here is a typical example of an electrical connection problem that was solved by CADWELD.

Twelve magnet wires (secondary windings of a resistance welding transformer) had to be connected to the output cable leads.

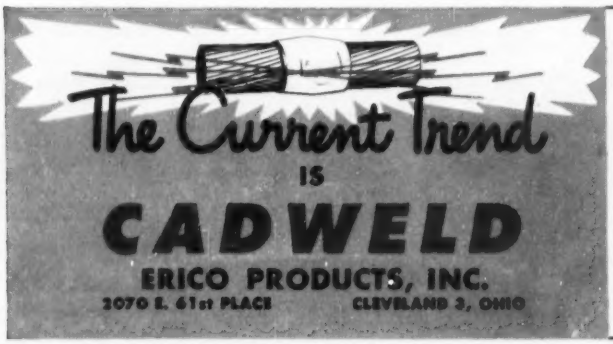
The finished connection had to:

1. **Be small in over-all dimensions for reinsulation and assembly.**
2. **Be capable of withstanding high surge currents.**
3. **Be unaffected by continual high operating temperatures.**

WITH CADWELD

1. **Any shape or size conductor (copper or steel) can be connected with standard equipment.**
2. **Connections have current carrying capacity equal to that of the conductor.**
3. **Connections cannot loosen or corrode.**
4. **Equipment is portable—IDEAL for field use—no outside source of power or heat required.**

***For the best in* ELECTRICAL CONNECTIONS**



ERICO PRODUCTS, INC.
2070 E. 61 St. PLACE CLEVELAND 3, OHIO

☐ Send Descriptive Literature on CADWELD Electrical Connections

☐ Have Representative Call

NAME _____ POSITION _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Tapping rubber from one of the millions of trees on U. S. Rubber's giant plantations in Malaya.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables · Street Lighting · Royal Cords · Network Cables · Utility Control · Pole & Bracket Cable · Service Entrance · Weatherproof · Zip Cord Pole Fixture Cable · Sup. Control

RAILROADS: Power Cables · Communications · Railway Signal · Royal Cords · Welding Cable · Railway Utility · Sup. Control · Weatherproof

HEAVY INDUSTRY: Power Cable · Royal Cords · Welding Cables · Control Cables · Machine Tool Wire · Building Wire · Switchboard Wire · Thermostat Cable · Bus Drop Cable

Absolute Tops in OZONE MOISTURE HEAT Resistance

U. S. RUBBER'S BUTYL-INSULATED POWER CABLES

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 80 C. The insulation will not crack after four hours in air containing 0.015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalies and corrosive chemicals. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Butyl Insulation			Neoprene Jacket	
	Unaged	After 168 Hrs. in O.B. at 80 C.	After 7 days in Air Oven at 250 F.	Unaged	After 96 Hrs. in O.B. at 70 C.
Tensile, lbs. per sq. in.	600	500	400	1800	1600
Elongation, per cent	400	350	350	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

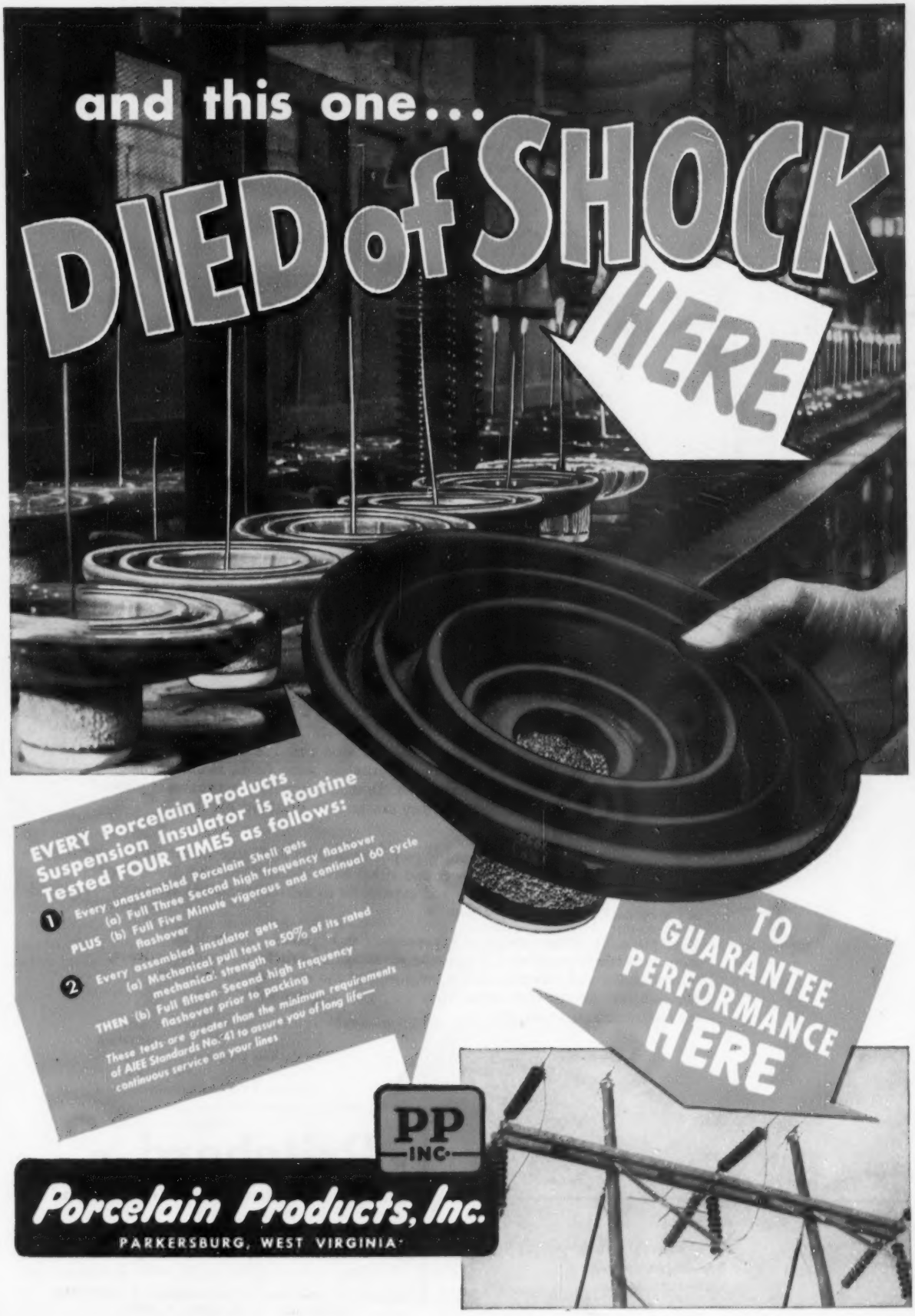
a. Dielectric constant and power factor of insulation after immersion in water at 50 C.

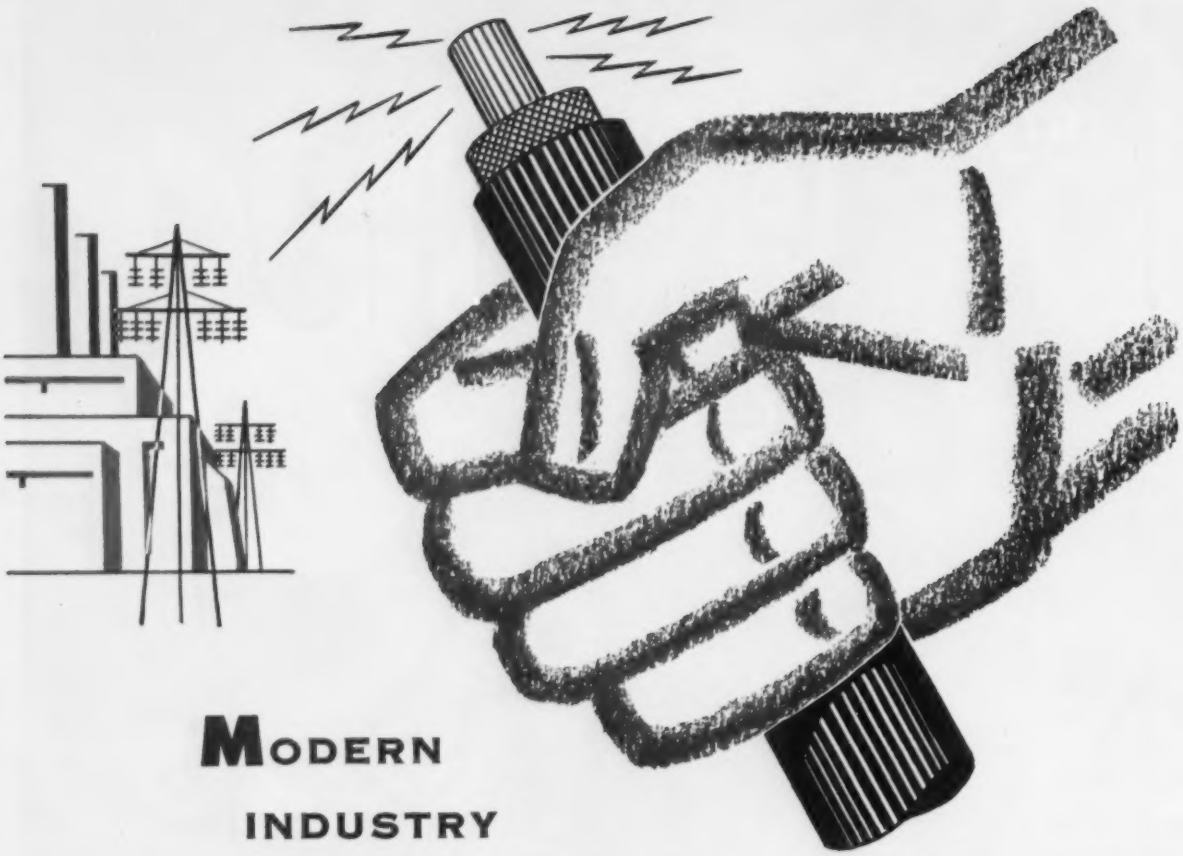
Dielectric constant, one day	4.0
Per cent gain, 1 to 14 days	2.0
Per cent gain, 7 to 14 days	1.0
Power factor, one day, per cent	2.0
b. Mgs. per sq. in., 7 days at 70 C.	15.0

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N. Y.


and this one...
DIED of SHOCK
HERE
EVERY Porcelain Products Suspension Insulator is Routine Tested FOUR TIMES as follows:
1 Every unassembled Porcelain Shell gets
(a) Full Three Second high frequency flashover
PLUS (b) Full Five Minute vigorous and continual 60 cycle flashover
2 Every assembled insulator gets
(a) Mechanical pull test to 50% of its rated mechanical strength
THEN (b) Full fifteen Second high frequency flashover prior to packing
These tests are greater than the minimum requirements of AIEE Standards No. 41 to assure you of long life—continuous service on your lines
TO GUARANTEE PERFORMANCE HERE
PP INC.
Porcelain Products, Inc.
PARKERSBURG, WEST VIRGINIA



MODERN INDUSTRY CHOOSES PRITCHARD EFFICIENCY

The plans of farsighted industrial leaders stress one vital need—increased efficiency from their power generating facilities. In some fields, more efficient operation requires extensive modernization. In others, necessary expansion is planned. Whatever the need, these men know they can rely on Pritchard for the modern facilities they require.

For more than a quarter of a century, corporate utilities and large industrial users of electric power, diesel power and steam have chosen Pritchard for generating stations, alterations and expansions to deliver maximum efficiency at lowest cost.

Your plans for modernization or expansion of your power plant will be more successfully completed if you take advantage of Pritchard's long experience, proved ability and *complete* design, engineering and construction facilities. For complete information, write today . . . your inquiry will receive immediate attention.

Industry's Partner for Progress

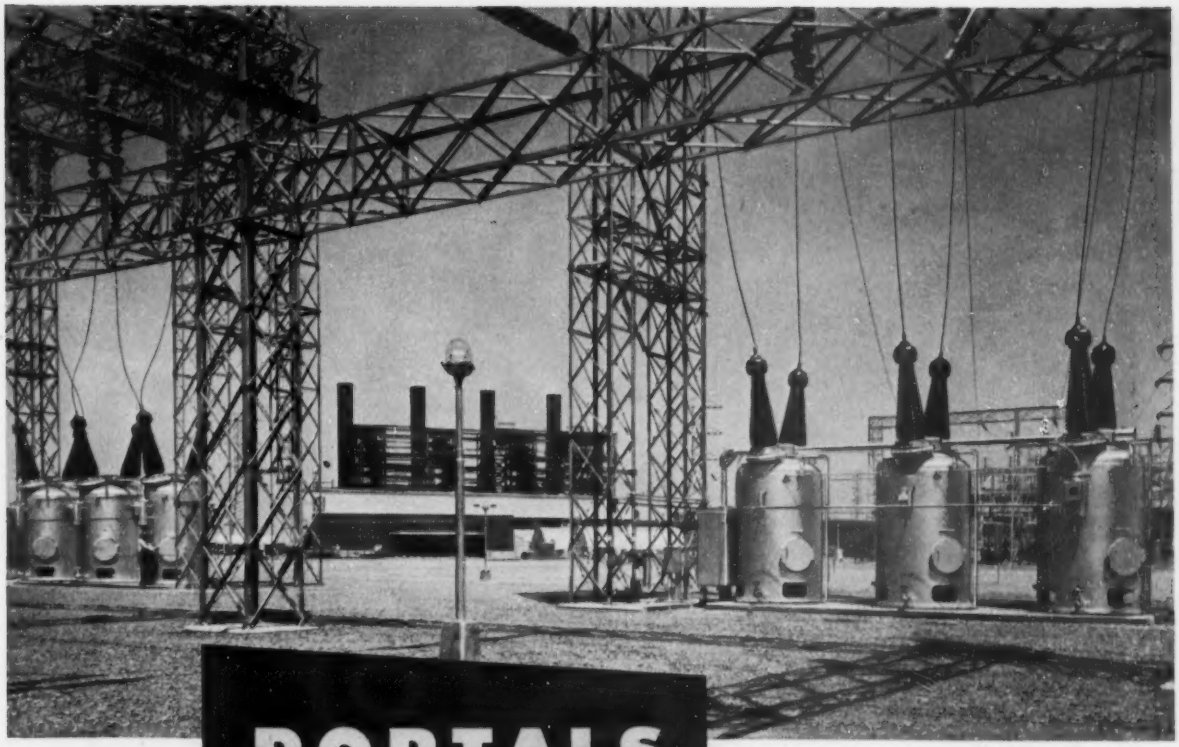
Serving the Gas, Power, Petroleum and Chemical Industries

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

Dept. 339, 210 West 10th Street, Kansas City 5, Mo.

CHICAGO • HOUSTON • NEW ORLEANS • NEW YORK
PITTSBURGH • ST. LOUIS • TULSA



ASA, AIEE and NEMA STANDARD

PORTALS OF POWER

PACIFIC ELECTRIC CIRCUIT BREAKERS

STANDING GUARD over an apparatus and line investment of millions are these two (of five) 230-kv, 1200-amp, Type RHE Pacific Electric Oil Circuit Breakers . . . in the switchyard of a 625,000 kw steam plant nearing completion in the Far West.

Each circuit breaker has a 3-cycle interrupting rating of 10,000,000 kva.

All 230-kv and 115-kv air switches for disconnecting, by-pass, bus transfer, and sectionalizing in the switchyards of this plant are also Pacific Electrics.

Pacific Electric High Voltage Outdoor Switchgear . . .

Oil circuit breakers and air switches, 7.5 to 287.5 kv.

Distribution service restorers.

Power-fuse and distribution switches, cut-outs, and supports.

THE SELECTION of Pacific Electric circuit breakers for key-point duty on many leading power systems is recognition of their proved protective performance, reliability, and low cost of maintenance.

FEATURES

- Simple self-pressurizing interrupters; their exceptional performance is due to improved utilization of directed oil flow and to high speed of developing open-gap distance.
- Only one moving structure within each tank.
- Oil-hydraulic restoration of closing energy.
- Opening accelerating springs and shock absorbers are outside of the tanks.
- Electrically and mechanically trip free in any position, even during high-speed reclosing.

Since 1906

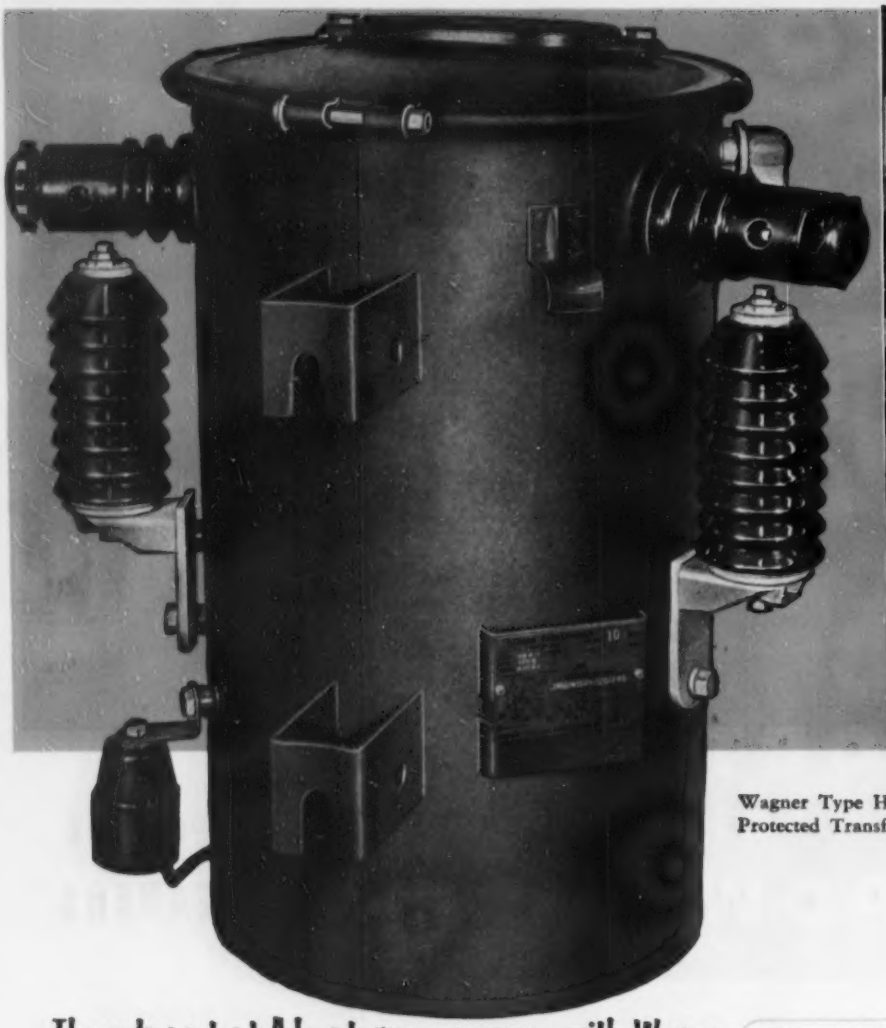
SALES OFFICES or AGENCIES in PRINCIPAL CITIES

PACIFIC ELECTRIC MFG. CORPORATION

SUBSIDIARY OF FEDERAL ELECTRIC PRODUCTS COMPANY

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA

OTHER FACTORIES: SANTA CLARA, CALIF.; SCRANTON, PENNA.



Wagner Type HEB-1
Protected Transformer.

These Important Advantages are yours with Wagner Form W Transformers

HIGH VOLTAGE SIDEWALL BUSHING

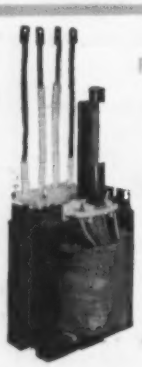
Now you can make faster, easier, safer, permanent connections. Conductor slips into connector—no special tools are needed—and connector can be tightened by turning the insulated finger-grip knob.

PRE-SET LINE TO ARRESTER ISOLATING GAP

This design incorporates a bushing and arrester assembly that occupies minimum tank space and provides permanent connections with the arresters isolated from the line.

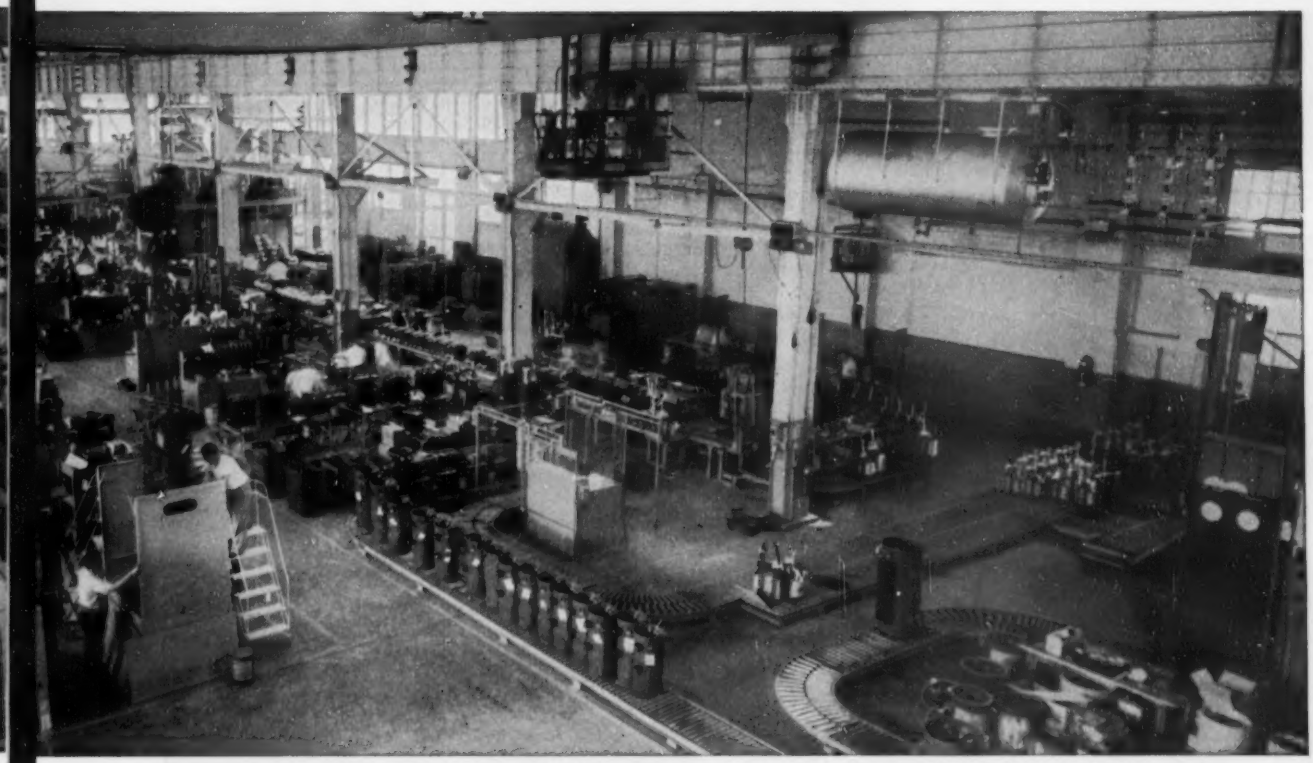
SHUR-SEAL CLAMPED COVER

You get actual sealed-tank construction with cover sealed to the tank with the Wagner SHUR-SEAL Clamping Ring. "Breathing" is completely prevented. No oil can be lost during shipment or handling.



FORM W CORE AND COILS

Wagner Form W Construction, with preformed cores of cold-rolled, oriented grain steel, permits a liberal design in small size, light-weight transformers that give excellent electrical performance.



New Wagner Plant Speeds Production of Form W Distribution Transformers

Now, Wagner's expansion program provides a new plant, devoted exclusively to the manufacture of transformers, that will help speed production of Form W Distribution Transformers to meet the demand created by the nation's growing power load.

Form W Transformers are exactly right for modern distribution systems. Their small size and light weight makes them easy to handle — to store — to mount on poles. They are available in ratings up to 167 kva, with protective devices to meet any need.

Choose Form W Transformers for your next installation — they pay dividends in longer service life.

Wagner maintains a nationwide organization to provide fast, convenient service, with branches in 32 principal cities.

Wagner's complete line of distribution transformers includes every rating and design listed in the E.E.I.-NEMA Fifth Report. Choose Wagner and get the benefit of improved design, quality construction and high efficiency with *standardized* mechanical features in ratings of 500 kva and below. Bulletin TU-180 gives complete information on Wagner Distribution Transformers. Write for your copy today.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T54-5

Handclasp of a friend-in-need

There's confidence in the very "feel" of the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers. The quick-acting "Squeez-Grip" fits your hand naturally like a handclasp... hangs right... carries right... works right. You're in complete command of the situation instantly... no fumbling... no fatigue.

From the non-conducting, shatterproof discharge horn to the high strength, durably finished cylinder, you get top quality construction that results in a lifetime of satisfactory service. Because of the very few working parts and corrosion resistant materials throughout, the total cost to you over the years is less than other initially lower priced makes... fire after fire, recharge after recharge, without trouble.

It's not hard to see, when you fully compare and try, why C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers are your best buy for killing flammable liquid and electrical fires, as well as some surface fires involving ordinary combustible materials. Sizes range all the way from 2½ to 100 pounds capacity... all fully approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus.

With C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers the penetrating carbon dioxide is a clean, dry, non-damaging, non-conducting, inert gas... smothers fire instantly, leaves no after fire mess... harmless to equipment, materials and finishes... even food is still perfectly edible.

Act now for complete free information on these first-rate, sure-acting fire extinguishers. Remember fire doesn't wait ... get the facts today!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY

C-O-TWO FIRE EQUIPMENT OF CANADA, LTD. • TORONTO 8 • ONTARIO

Sales and Service in the Principal Cities of United States and Canada

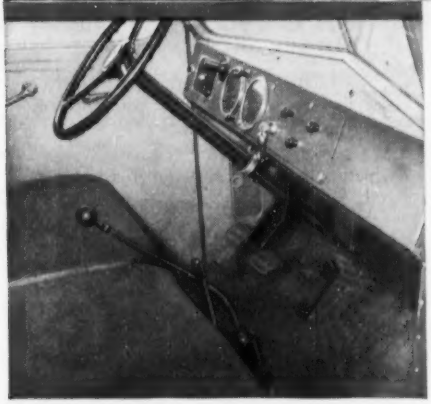
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

NEW FWD FOURMASTERS

with

MATH • MATIC DESIGN

meet today's Utility needs
for more versatile truck performance



IMPROVED ALL-STEEL SAFETY CAB — Live rubber shock absorbers and improved twin-pivot support dampen off-the-highway jolts; adjusting comfort seat is a full 70" wide; suspended, cab-mounted foot pedals assure leverage regardless of driver height, eliminate floor openings.

With more and more off-the-highway locations and relocations in the picture, your *need* for units that *don't* need roads is greater than ever before. New FWD FOURMASTERS with exclusive Math-Matic Design *put the power where there's work to be done* by properly proportioning torque to weight.

Up to 82% greater tractive ability*—30 to 37% longer tire life*—same fuel consumption as rear-wheel drive trucks*—safest by far to operate under any on-or-off-the-highway conditions* . . . these are the dollar and sense reasons why utility officials everywhere are turning to new FWD FOURMASTERS with Math-Matic Design. THE FOUR WHEEL DRIVE AUTO CO., CLINTONVILLE, WIS., *Canadian Factory*, KITCHENER, ONT.

FWD

MATH • MATIC DESIGN

BUILDERS OF AMERICA'S FOREMOST HEAVY-DUTY TRUCKS

*TRUCK RESEARCH PROJECT CONCLUSIONS . . . *For the published results of 7 years' intensive research by the University of Wisconsin's College of Engineering, write now for your free copy of "The Truck That Went to College."*

HERE'S
Superior Line Construction and Maintenance
BECAUSE:

ULCO is *PINPOINTED* To Your Job!

COMPLETE EQUIPMENT . . .
carefully operated, well maintained.

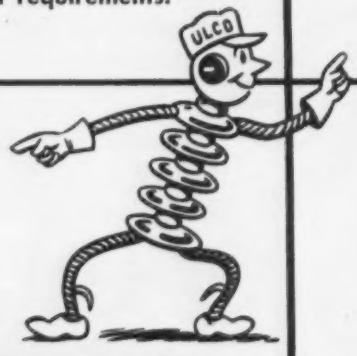
EXPERIENCED CREWS . . .
expandable as the job requires.

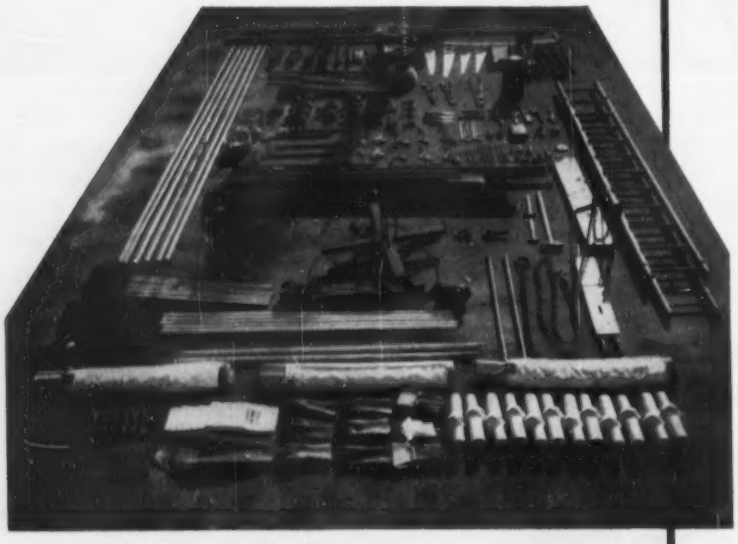
INSURED SAFETY . . .
proper working standards assured—and insured!

CONTRACTS . . .
drawn to your individual requirements.

"The Right Tools At The Right Time At The Right Place"

Tools and equipment . . . modern, up-to-date, time-saving . . . are used by Utilities Line Construction to do the best job in the quickest, safest way; *superior* line construction and maintenance!





Illustrated is a typical "load" of tools which accompanies our skilled workers on every job. They are most important.

In addition to these tools, ULCO maintains a fleet of modern trucks, properly designed, carefully operated and well-maintained, to give you more dependability, extra work and good public relations.

Constantly, ULCO is adding to its special equipment—assuring you superior line construction and maintenance.

ULCO is a "package" service in which we handle the entire line construction and maintenance jobs for you, supplying skilled crews in the number needed, providing all tools and equipment—observing safety standards—emphasizing public relations.

ULCO is at your service. We invite your inquiry today. Every job is done to the specific requirements of the company.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
505 YORK ROAD · JENKINTOWN · PA. · Phone OGontz 8300

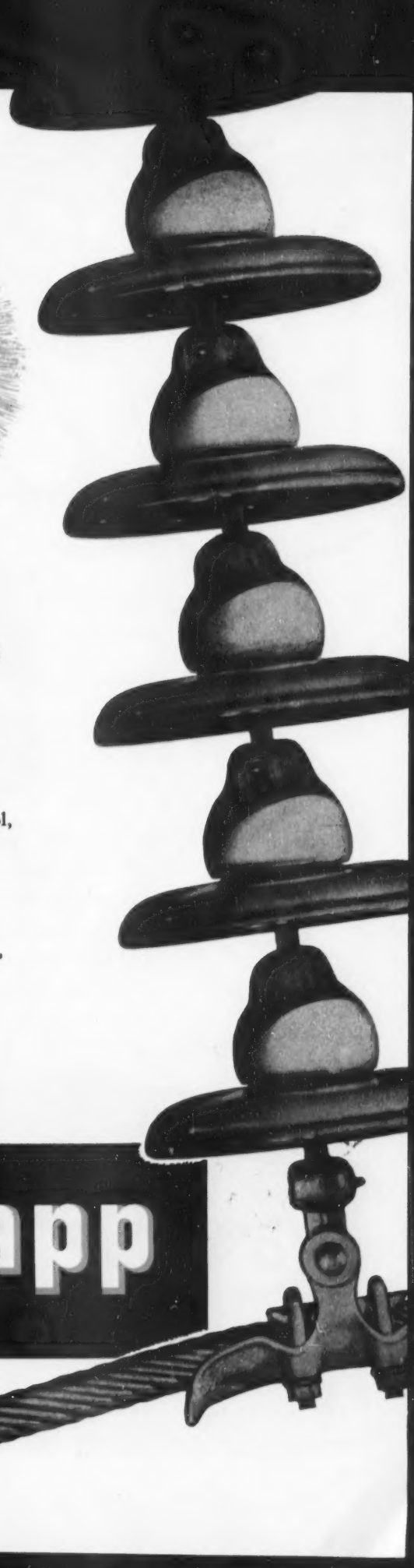
ANY SUSPENSION INSULATOR WOULD BE GOOD ENOUGH *if*

The "standard specification" for suspension insulators undoubtedly provides for all characteristics necessary to insulate your transmission lines. You are safe to buy any insulators under such a specification . . . *IF* . . . *IF* a sufficiently thorough testing program authenticates the fact that the insulators you buy *do* meet the specifications. And *IF* you have evidence that they will still meet the specifications after years of service.

Lapp knows that those are big *IF's*. So big, in fact, that it's not at all safe to assume that "all suspension insulators are alike." Lapp could not be producing the quality of insulators it ships today without a continuing research and development program in insulator design, raw material control, production methods, glaze fit, sanding and cementing techniques —and a never-interrupted program of severe electrical and mechanical testing.

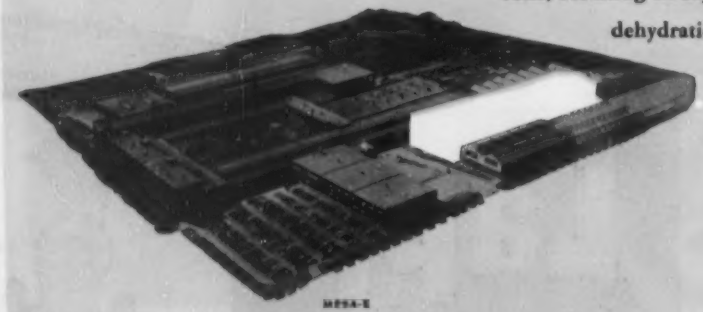
If you want lines which will stay in trouble-free service over the years . . . we suggest you look beyond the "standard specification." When you've found the real differences in suspension insulators, you'll find, as so many companies have, that there's a positive extra margin of operating safety and security . . . long life . . . and low upkeep . . . on lines built on Lapp insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.



WE'VE GOT THE KEY TO GREATER CAPACITY!

Yes, the key to greater capacity, that is the key to our new additional assembly facilities, has been turned over to us and we're ready to go! Now, at last, we can cut into that backlog of orders so badly needed by our utility and industrial customers. With our new added facilities and greater production capacity, delivery dates are being appreciably improved and so is our capacity to build bigger and better transformers. Here, under one roof, are the latest and best facilities for fabricating the largest power transformers. Facilities to shorten production time . . . to fabricate and test the newest ideas and designs for power transformers. Better core assembly . . . better coil fabrication . . . concentric winding, integrating more compactly the mass of high and low voltage coils, resulting in superior performance. Core and coil drying . . . by dehydration in addition to vacuum . . . faster, and without damage from heat.

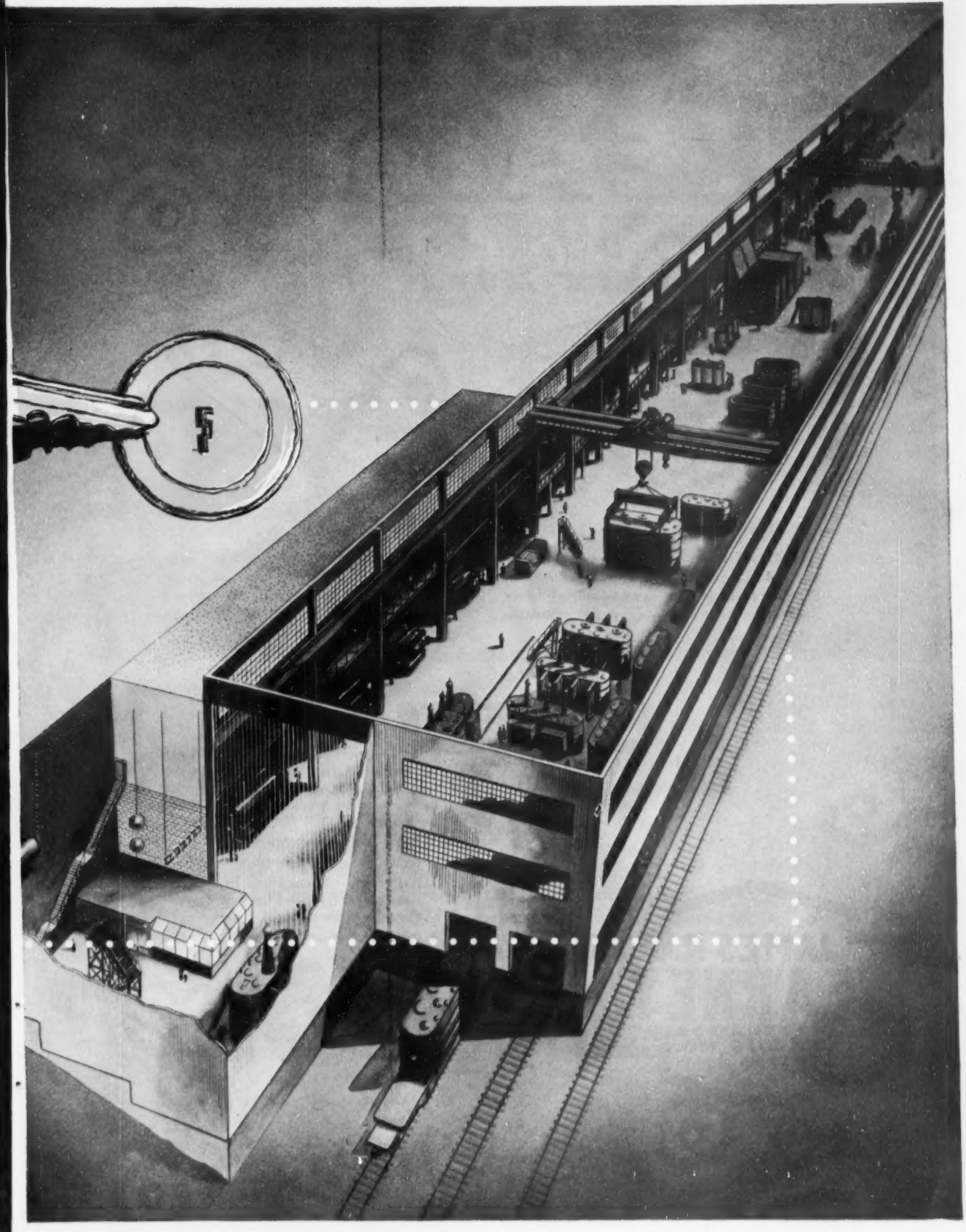


All this to meet your needs . . . and here it is all ready to go to work for you to help you keep up with the demands your customers are making on you.

MOLONEY ELECTRIC COMPANY

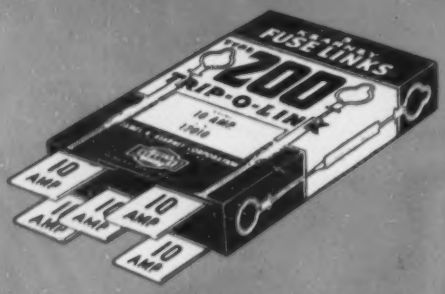
Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONT., CANADA



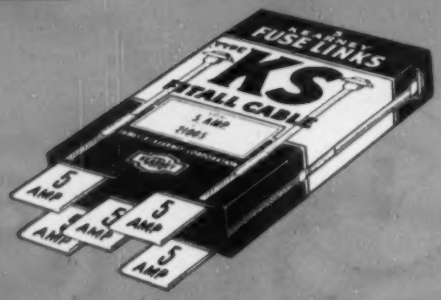
SAVE SAFELY on KEARNEY

4 Specialized types for maintaining



KEARNEY Type 200

Specially made for troublesome circuits that are subject to long-time overloads and surges. Overloads up to 150% can be carried indefinitely without damage to fuse link or cutout.



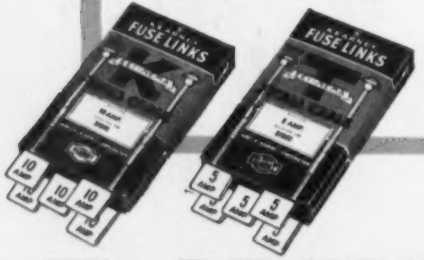
KEARNEY Type KS

Specially designed to protect and still keep outages at a minimum on circuits subject to switching and lightning surges. KS overload capacity is identical with Type 200, but surge capacity is twice as great.

Standardized types for EEI-NEMA Standards

In cooperation with EEI and NEMA, KEARNEY has developed K (fast) and T (slow) fuse links to meet industry-wide, time-current standards . *in addition* to giving you such exclusive KEARNEY features as:

1. True mechanical interchangeability
2. Greater accuracy and dependability
3. Packages are color-coded (gold for Type K—silver for Type T) to assure fool-proof identification and save time on the job
4. Easy-to-use, "pull-out" package

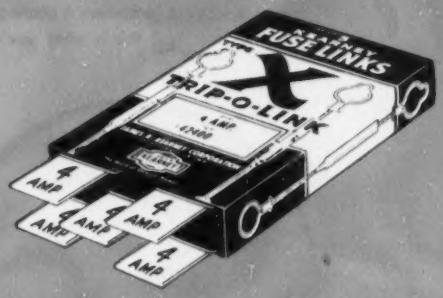


JAMES R. KEARNEY CORPORATION
ST. LOUIS, MO.
GUELPH, ONT.

Specify KEARNEY

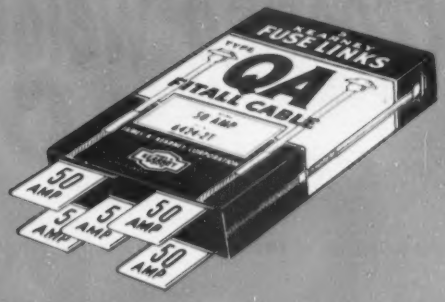
peak load protection
FUSE LINKS

service on troublesome circuits



KEARNEY Type X

A specialist at keeping transformers in service during heavy overloads and surges... yet clears the fault before damage range is reached. Opens 230% of rated current within five minutes.



KEARNEY Type QA

The QA link is designed to open at a lower percentage of rated current, and therefore will melt more rapidly than fuse links of the same ampere rating which have been designed to open 230% of rated load within five minutes.

Keep your troublesome circuits operating even under most difficult conditions—by re-fusing with KEARNEY links. They will save you more in maintenance—and do it *safely* Equipment gets full protection from overloads and surges.

All KEARNEY links are color-coded to save your crews time and trouble, packaged for easy handling, and made with the accuracy you need for top protection. Time-current curves and charts are available to help you work out your coordination problems.

JAMES R. KEARNEY CORPORATION

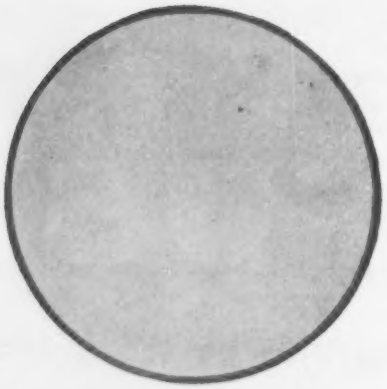
4224-42 Clayton Avenue • St. Louis 10, Missouri

Canadian Plant: Guelph, Ontario

FOR BETTER CONSTRUCTION • FOR SAFER MAINTENANCE

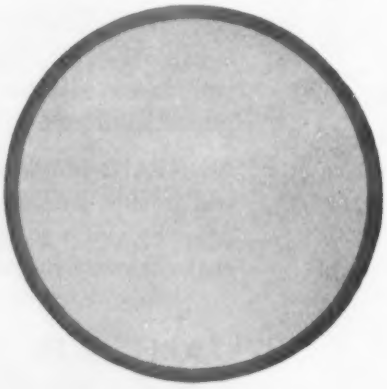
Products

Why be limited to a single coating weight?



If a wire with the Bethlehem A coating were greatly magnified, this is what you'd see.

Now look at the B coating. Same high quality as the A, and twice the thickness.



C coating, for extreme cases, is three times as heavy as A, 1½ times as heavy as B.

Before purchasing your next lot of strand, be sure to consider the following important points:

The strand you choose should match the life-expectancy of your poles, towers, and other structural units. In many installations, Bethlehem strand with the A-weight bethanized coating (equivalent to extra-galvanized) is perfectly satisfactory. But there are, of course, many locations where economy dictates a heavier jacket—for instance, the Bethlehem B-weight coating. The B is twice as thick as the A, and will normally last twice as long under similar conditions.

Then there's a still heavier coating, known as C, for extremely corrosive atmosphere. This is triple the weight of A; it is an "armor" that really defies the years.

Thus, when you specify Bethlehem strand with the ductile bethanized jacket of zinc, you are not limited to a single coating weight that may or may not suit your long-range plans. With a choice of three coatings available, you can select the strand *that will last as long as the other line components.*

We'd like to give you the full story, including all details of our bethanizing process—the method of bonding zinc to wire electrolytically, so that it doesn't check, crack, or peel. May our representative call and explain how bethanized strand will do the job you want?

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

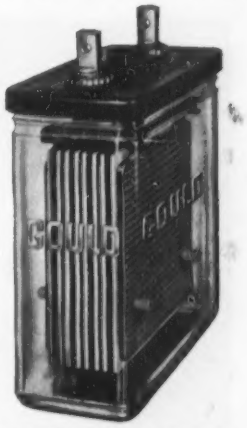
BETHANIZED STRAND

LASTING POWER

for Telephone, Switchgear, Alarm, and Emergency Applications...

THANKS TO BATTERY POWER!

When emergency strikes, you never know how long it will stay with you. That's where the unequalled lasting power of Gould Planté Batteries pays big dividends. The positive plates of these finest stationary batteries available today, are PURE LEAD! They constantly renew active material as the battery floats. Gould Planté Batteries maintain top capacity, provide tremendous reserve power for years after ordinary stationary batteries have to be replaced. It's the lowest cost stand-by power you can buy! *Standardize* on *Planté!*



Specify
GOULD PLANTÉ—
The Aristocrat of
Stationary Batteries

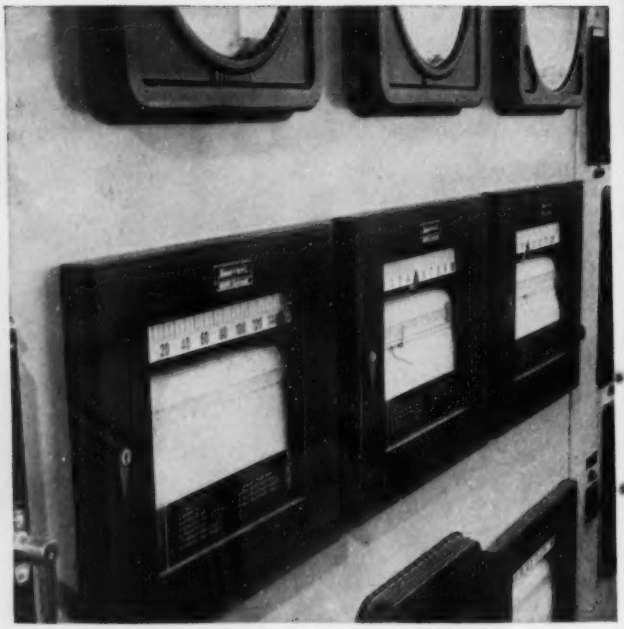
GOULD INDUSTRIAL BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

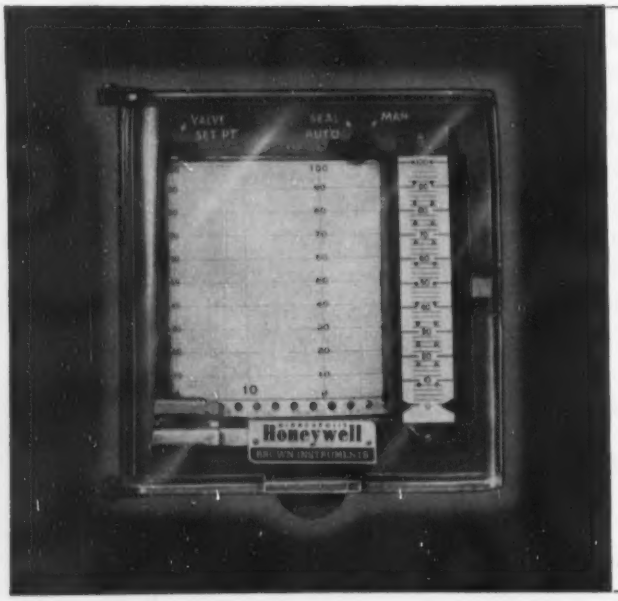
©1953 Gould-National Batteries, Inc.

FUNCTIONAL DESIGN *is the keynote of the New Murray Gill Station designed by Ebasco for Kansas Gas & Electric Co. Above is an outdoor-mounted 47,000-kw generator unit.*



ON THE BACK OF THE CONTROL PANEL *are grouped full-size instruments such as these* ***ElectroniK*** *temperature recorders. But look on the operating side . . .*

Tel-O-Set recorders on compact

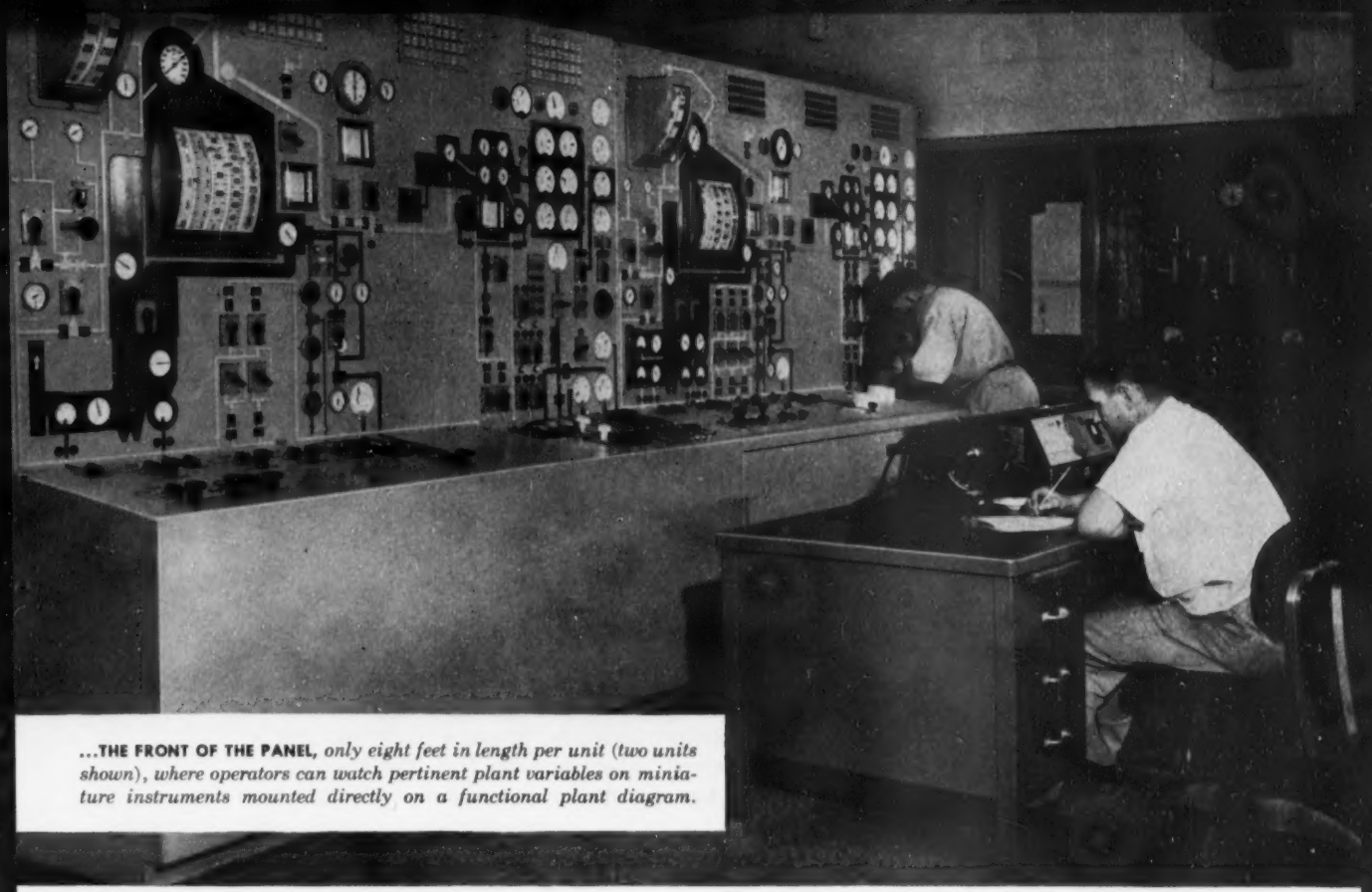


Every feature you need in a miniature recorder

Tel-O-Set recorders are applicable to measurements of temperature, pressure, flow and liquid level. They embody a simple, rugged pneumatic receiving system that is actuated by low-pressure air from the remote transmitter.

The recording chart moves horizontally. A full 8-hour record is quickly available.

The panel cutout required is only five inches square. In the mounted position, the instrument can be withdrawn from its case for easy inspection and adjustment.



...**THE FRONT OF THE PANEL,** *only eight feet in length per unit (two units shown), where operators can watch pertinent plant variables on miniature instruments mounted directly on a functional plant diagram.*

show critical trends graphic control panels

BOILER and turbine control panels, which used to stretch for dozens of feet along the sides of a central control room, are now being compressed into small, convenient size. The key to this new technique, pioneered by Ebasco in the power industry, is graphic instrumentation . . . which displays all vital operating variables on a plant diagram. Graphic panels bring complete plant operation into sharp focus . . . improve operator's efficiency . . . speed training of new men . . . and simplify start-up and emergency control.

For displaying the many variables which need more than instantaneous indication, *Tel-O-Set* miniature recorders are ideal on graphic panels. They take no more panel space than many dial indicators. And they provide a record which reveals trends, so that operators can know which way related variables are moving, and how fast.

When you're planning graphic instrumentation, plan to utilize *Tel-O-Set* recorders for these essential "trend indicators." Your nearby Honeywell sales engineer will be glad to discuss how they can be applied to your own control panels. Call him today . . . he's as near as your phone.

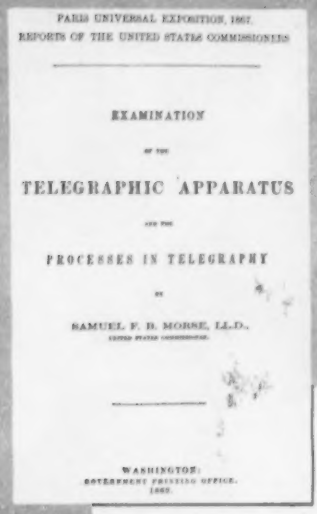
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Aves., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for new Bulletin No. 9050, "Instrumentation for Steam Generation."**

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls


PARIS UNIVERSAL EXPOSITION, 1867.
REPORTS OF THE UNITED STATES COMMISSIONERS

EXAMINATION

OF THE

TELEGRAPHIC APPARATUS

AND THE

PROCESSES IN TELEGRAPHY

BY

SAMUEL F. B. MORSE, LL.D.,

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1867.

KERITE'S 100th Anniversary

1854—1954

Read what Professor B. Silliman of Yale University reported on the Kerite insulation exhibited at the Paris Universal Exposition of 1867.

TELEGRAPHIC APPARATUS, ETC.

DAY'S KERITE INSULATOR.

The kerite compounds of Austin Goodyear Day, mentioned in the following memoir, were honored by two medals and an honorable mention by the jury of the Exposition Universelle, to whom the subject was referred. These awards covered other products than the electrical cables and insulators which are the special object of the descriptive memoir.

NOTE UPON INSULATION AND KERITE, BY PROFESSOR SILLIMAN.

The exhibition of the kerite, this product of the persevering labors and experiments of Mr. Day for so many years, furnishes an example of the not infrequent inappreciation, or rather overlooking, of an invaluable discovery, when modestly presented, as in this case, among the more showy articles by which it was surrounded.

True, it received honorable mention as "artificial India-rubber," and a bronze medal for its very limited application to "India-rubber cases;" but its superlative value as a substitute in insulation for India-rubber and gutta-percha was not, for it could scarcely be, appreciated, presented as it was simply in one of its more ordinary applications; so that heedless neglect is not charged upon the jury, but it is mentioned rather as an example of the existence of an unnoticed quality in an apparently trifling discovery, necessarily latent to superficial inquiry; a quality which is destined in this case to have a most important bearing upon submarine and subterranean telegraphy.

The kerite, in its condition simply as artificial [illegible] ssed under

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

Service Rules and Room Air Conditioners

"Why should we bother about starting current and power factor? Sure, I know most electric utilities have service rules covering motor-driven appliances. But they don't police their rules, and I guess they don't care."

The foregoing is not an exact quote, but it states the feeling of one manufacturer of fractional horsepower motors. It was expressed last fall to an Electrical World editor at an AIEE conference on the application of motors to air-moving equipment. If one manufacturer feels that way, perhaps others do, too.

Makers of appliance motors should give more attention to starting current and power factor. They will probably be compelled to do this if other utilities follow the lead taken recently by the Union Electric Co of Missouri. This company has served notice on manufacturers of room air conditioners and their distributors and dealers that, beginning Jan. 1, 1955, Rule No. 2.21 of its Electric Service Manual will be applied.

The rule states that in cases "of low power factor, high motor-starting current, violently fluctuating loads, etc, the company reserves the right to require the customer to install, at his own expense, apparatus to correct the objectionable condition." Application of the rule is deferred to 1955 because the company realizes that it is rather late for corrective measures to be incorporated in conditioners produced for sale this year.

There are three requirements that should be built into every electrical appliance—safety, satisfactory performance, and load characteristics acceptable to the electric utility. If an appliance is not safe, its sale will be prohibited. If it is not satisfactory, it will not last long in the market. If it does not have acceptable load characteristics—well, maybe the utility will not say anything about it; and the buyer will never know. Thus the manufacturer has had an opportunity more or less to skimp in this respect in order to meet price competition. But in St. Louis, if nowhere else, the buyer is going to know.

If the buyer of a room air conditioner finds he must peel off some more folding money "to install at his own expense" some gadget he never heard of, before he can enjoy comfortable sleep through a sweltering St. Louis summer, then he is going to be somewhat peeved at the dealer who sold the machine. And that won't be nice for the dealer, the distributor, and the manufacturer. Union Electric thoughtfully points out this consideration in its notice of application of Rule No. 2.21.

There are about 1.4-million room air conditioners now in use in American homes. It is generally expected that sales will pass the million mark this year. The business is certainly growing, but it is still young. "As the twig is bent so is the tree inclined." Now is the time for the utilities and manufacturers to see to it that the twig is bent to make the tree incline the right way.

Industrial Heating Is Important

Just how important is industrial electric heating to utilities?

This question can be partially answered by the outstanding success of the IEC National Industrial Electric Heating Conference held Jan. 18-22 at Cincinnati (EW, Feb. 15, p 47). The total conference enrollment was 220. Fifty-seven utilities, from as far away as California, Colorado, Texas, and Quebec were represented; also 39 equipment manufacturers. The attendance at each of the sessions was high, and it remained high over the entire conference.

The very fact that this group sat through five long days and listened to and discussed 54 papers is proof enough of the interest shown and the importance of this subject.

This meeting represented the first phase of the Industrial Electrification Council's program to provide a means for better coordination at the national level of the educational and promotional efforts of the electric utilities and the industrial electric heating equipment manufacturers.

One of the most significant indications of the importance of the industrial electric heating load to utilities was brought out in the figures presented by J. H. Ahrens, Hartford Electric Light Co, in estimating the market for metal sheath electric heaters. Ahrens estimated the 1950 annual utility revenue for purchased kilowatt hours for metal sheath heaters alone at $158 million and forecast a 1962 figure of $626 million. This represents a growth from an estimated connected load of metal sheath heaters of 8,300,000 kw in 1950 to 26,100,000 kw in 1962.

But this rosy forecast can only be realized by broad sales promotional activities by the electric utilities and manufacturers to develop a broader acceptance of electric heat in industry.

"Electrical Modernization"

No one ever bought a turbo-generator, a power transformer, a 220-kv insulator, or any of the myriad pieces of equipment that compose an electric energy supply system just for the simple pleasure of ownership. Each such purchase is made because the buyer has a use for the thing specified in the order.

Those two words, "the order," state completely the end and aim of practically all selling effort in the field of such equipment. Get the order. And for the one manufacturer who gets the order, there are others who tried but did not get it. This is competition, a good, healthy thing, "the life of trade."

How many makers of power system equipment give thought to what lies behind the order they try so hard to get? Does attention to the competitive, the get-the-order aspect of their selling crowd out of their minds any concern about why there is a market for their products?

The answers to these questions will appear in the number of such manufacturers who support, and the amount of support they give to, the idea of "Electrical Modernization" which was announced last fall as the aim of the electrical industry.

The genesis of every order for whatever kind of apparatus and equipment in power plants, transmission lines, substations and distribution systems is in human desire. There can be no electrical modernization of homes, factories, stores, offices, unless desire for the benefits and amenities it offers is inculcated in the people who live and work in them. Electrical modernization will have to be sold.

Responsibility for this selling job does not lie entirely on the shoulders of those who supply the goods and the service that must be bought by the people who have been persuaded to want electrical modernization. Part of the responsibility rests on those who compete for the orders that had their beginnings in the desires of people for more of the benefits and amenities of electricity. The number of those orders and the size of them depends on how effectively electrical modernization is sold. This is a job for the whole electrical industry.

A Government and Utilities Cooperate

On March 2, Central Hudson Gas & Electric Corp will dedicate its Neversink hydroelectric project. This is not news that will rock the industry. In size the Neversink Plant can be classed as puny, a mere 25,000 kw. But the conditions under which it was built make the plant an object lesson to the industry and all those who concern themselves with the generation of electricity.

Neversink project is proof that when a government is willing, it can get together with private enterprise to develop an area's resources for the benefit of all the people. The government involved in this project is that of the City of New York. The city's Board of Water Supply had condemned the site on which Central Hudson had planned to build the Neversink project (EW, June 1, 1953, p 78). Then reason prevailed. The city and the company got together. Now from the project the company will get electric energy, and the water discharged from the turbines will go on to quench the thirst of New Yorkers.

Nearby the Rockland Light & Power Co is building its 18,000-kw Grahamsville Plant under similar terms with the city.

These splendid examples of government-industry cooperation may well be followed in other areas of the country.

Jubilee Must Not Forget Engineers

This year the industry will observe Light's Diamond Jubilee. The nationwide celebration will commemorate the invention of the incandescent lamp by Thomas A. Edison. Actually that lamp is less famous for the light it gave than for the fact that it was the seed from which a mighty industry grew. But the industry grew not because of Edison alone. It grew because of thousands of engineers and scientists whose inventions and research built the industry as a wall is built, stone by stone.

Light's Diamond Jubilee will be but a mockery unless the engineers are given an opportunity to participate in some way. The proper way to invite them is through their professional societies such as the American Institute of Electrical Engineers, the Illuminating Engineering Society, and the American Society of Mechanical Engineers. The earlier they are invited, the more they can contribute to the celebration of the industry they helped build.

THE ELECTRICAL WEEK

The Issue's News Highlights—Republicans are beginning to implement the Administration's policy of federal-local partnership in hydro power development.

House subcommittee gives no inclination it will raise funds for TVA above President's request . . . Two-dam plan for Middle Snake River submitted to Senate group.

Interior officials meet with co-op leaders on distribution of Clark Hill power. Decision expected soon.

Three Pacific Northwest governors plan to oppose Eisenhower Administration cuts in construction of Chief Joseph and The Dalles Dams. Meeting in Portland, Ore., Govs Paul L. Patterson of Oregon, Arthur B. Langlie of Washington and Len Jordan of Idaho decided to take the issue directly to the President. The proposed budget cuts would delay delivery of power from the two Columbia River dams a full year.

Eastern Utilities Associates, identified with Stone & Webster interests in Boston, announced it has applied to Atomic Energy Commission for authority to build and operate the first commercial-sized (60,000 kw) nuclear power plant AEC proposes to sponsor . . . In Washington, all AEC would say was that it had received a number of such proposals from industrial concerns and that these were under consideration.

Connecticut L&P overcame one legal hurdle toward building its much-disputed steam plant on Manresa Island off Norwalk, Conn. State Supreme Court upheld authority of Norwalk's zoning commission to permit the company to build the plant. The company will ask PUC for permission to use the island site.

A new 18-show series of "Better Living Television Theatre" was filmed in New York. Show, which includes panel discussions by industry leaders, will be presented by local TV stations across the country this summer. It was produced by Bozell & Jacobs, Inc, directors of Electric Companies Public Information Program. Fischer Black, editor of Electrical World, is moderator.

Interior proposal—for delivery of federal power in Georgia follows objective on long-term offer of Georgia Power Co. It is a three-contract affair under which government would sell power to company and designate preference customers to receive it. Customers would also have a direct government contract to insure their position. Third contract would be between customer and company for firming up federal power. Preference customers have 30 days to consider and comment on proposal. Former Gov Ellis Arnall, counsel for co-ops, labeled it "improper and of doubtful legality." (Story on earlier developments appears on page 93).

Off the Washington Wire . . . White House and State Department are running into tough opposition in attempts to relax the "Buy American" policy on government purchases. Lining up against any further relaxation are Defense and Interior Departments, along with the Treasury. Most of the large electrical equipment purchases go through Defense and Interior.

Construction will begin this spring on a 10,000-kw steam-electric plant for the U. S. Naval Gun Factory at Indian Head, Md.

FPC will hear testimony March 30 on a change in rules that would allow states and municipalities a 30% reduction on annual charges assessed in its licenses for hydro projects . . . The Commission has amended its rules to permit public documents, even though not actually offered, to be included by reference in hearing records.

Legislation calling for creation of a public works planning administration is being studied by government agencies affected. The bill, introduced by Sen Paul Douglas (D., Ill.) and Rep Richard Bolling (D., Mo.) stems from their dissatisfaction with Administration's approach to setting up a shelf of public works as a hedge against a possible depression.

Two Nashville AFL unions passed resolutions urging President Eisenhower to renominate Gordon Clapp as chairman of the board of TVA when his term expires May 18. Petitions urging this are circulating through the valley.

NARUC announced Ohio Public Utilities Commission had withdrawn from active membership in the association.

Creation of a new system planning subcommittee was announced by A. M. Debellis, chairman of EEI's Electrical Equipment Committee, at a meeting in Columbus. Chairman is R. G. Meyerand, Union Electric Co of Missouri.

From the '53 Annual Reports . . . Detroit Edison will spend half a million dollars on its nuclear power development program in 1954 . . . Florida Power Corp asserts it is the "fastest growing electric company in the Southeast and second fastest growing in the U. S."

Executive Changes—E. K. Albert, executive vice president of California-Pacific Utilities, was elected president to succeed late James A. Ward (See p 192) . . . Gulf States Utilities' four newly elected vice presidents are Henry V. Faber, William H. Gieseke, John J. Morrison, and L. V. Smith . . . R. W. Hurd and D. M. Kammert were named vice presidents of West Penn Power . . . Fred J. Gunther was appointed a vice president of Kansas City Power & Light.

GOP Implements Federal-Local Plans

● House bill would give Interior Secretary authority to work with non-federal groups on multipurpose projects

● Three other bills call for specific projects to be built under partnership principle

Republicans are out to chalk up some accomplishments in the field of local-federal partnership in the development of water power resources.

● House Interior and Insular Affairs Committee began hearings last week on a measure which would permit the Secretary of Interior to cooperate with non-federal agencies in development of multipurpose projects.

● Three other bills were in the legislative mill which would permit the federal government to join with local and state agencies to build specific projects with power features.

● Also before Congress is an Administration request that $10 million be appropriated to federal construction agencies for use in planning or building waterway projects.

Hopeful Outlook . . . Evidence was growing that local and state interests look to the idea of federal-local partnership as a real spur to waterway development needed in certain areas. The three bills involving specific hydroelectric projects appeared to have strong support in the communities involved even though the local interests would have to assume a sizable portion of the financial obligations.

Policy of local-federal participation in water power development is not entirely a new one. It takes on significance only because little attention was given it during the 20 years of Democratic rule.

The Hoover Dam, authorized during a previous Republican Administration, is a local-federal venture. At that huge project the federal government built the main structure as well as the power features. The turbines and generators, however, are leased to local interests which then purchase the falling water at the dam to power them. And it has long been a practice for local interests to bear part of the expenses for flood control and irrigation projects.

Rebirth of Policy . . . Chief contribution of the present Administration is to renew the policy of large-scale local participation in the power features of hydro-power projects.

Plea for more local participation in water power development was frequently expressed by candidate Eisenhower in the 1952 campaign. This idea became a basic tenet of the power policy statement issued last August by Interior Department. But it remains for Congress to put this policy into practice.

President Eisenhower recently endorsed the proposed approach to the Cougar Project in Oregon as a good example of his Administration's policy of encouraging local participation in such projects.

STATE-FEDERAL cooperation is proposed in construction of Priest Rapids Dam on Columbia

A bill introduced by Sen Guy Cordon (R., Ore.) would make the Cougar hydroelectric project a joint venture between the Army Corps of Engineers and the city of Eugene, Ore.

Under the bill, the Corps would build the $34-million project except for the powerhouse and generators. Eugene would build the power features and pay a fair share of other features of the project which contribute to power production. It is estimated that about $10.5 million of the total would be allocated to power and the city would assume this obligation. The project would have an installed capacity of 35,000 kw.

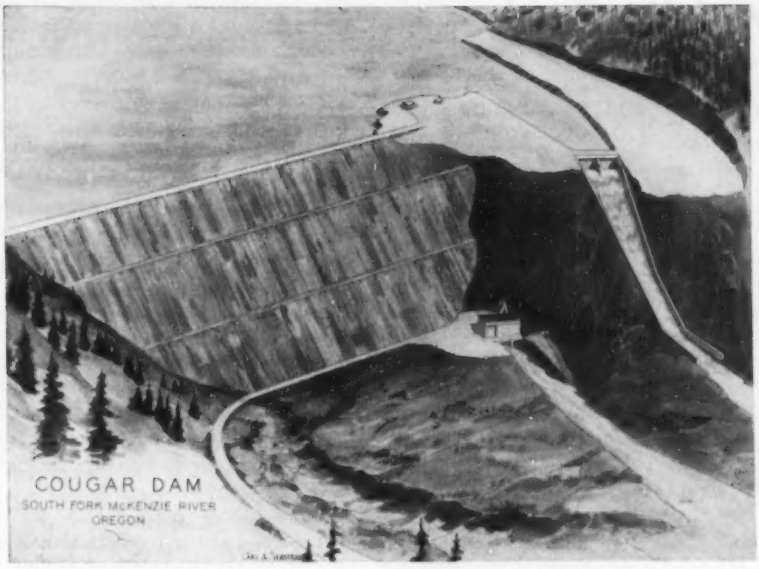
A federal hydroelectric license would have to be secured by the city to permit its participation.

Pioneer Venture . . . In his commendation, President Eisenhower said, "by joining with the federal government in the multiple purpose development of the McKenzie River, the city of Eugene is pioneering in the new concept of power development in the Northwest."

Why he chose to single out the Cougar Project for special mention is something of a mystery. Legislation is much further along which would permit state agencies in Washington to join with the federal government in developing the vastly larger Priest Rapids project on the Columbia River.

A bill was introduced last year for the joint venture at Priest Rapids and discussions have been in progress since. Within the past two weeks new measures have been introduced which appear to have the endorsement of all federal agencies.

Alternate Proposals . . . These would provide that the project, with an installed capacity of about 1 million kw, could be built either by state agencies or the Corps of Engineers. The Federal responsibility would relate to navigation locks and flood-control features. These are considered the non-



COUGAR DAM on south fork of McKenzie River is proposed as another local-federal venture

reimbursible portions of the project. The state-backed agencies would operate the power features and collect the revenue from them.

As planned by the Corps of Engineers and presently authorized by Congress, the Priest Rapids Project would cost an estimated $360 million. These plans call for a dam for developing a 150 ft head and an installed capacity of 1.2 million kw.

An alternate plan being discussed calls for a lower dam with an installed capacity of around 1 million kw costing an estimated $220 million.

Actually, the legislative measure furthest along relating to local-federal hydro development was introduced by one of the persistent critics of Republican power policy, Sen Robert S. Kerr (D., Okla.).

Passed to House . . . The Kerr bill has already passed the Senate and is slated for House debate within the next few weeks. It provides for state construction of the $40 million Markham Ferry Project on the Grand River. Under terms of the bill, the federal government would contribute as much as $6.5 million for the flood control features of the project. Existing plans call for an initial installed capacity of 36,000 kw and an ultimate installation of 72,000 kw.

The general bill on which hearings are now under way before a House committee is interpreted primarily as a boost for smaller projects having irrigation or reclamation features.

Introduced by Chairman A. L. Miller of the Interior and Insular Affairs Committee, the measure authorizes and directs the Secretary of Interior to participate with any local public body in construction of single or multipurpose projects.

Secretary Has Discretion . . . It will be left to the secretary to set up project standards and other procedures to protect any federal funds invested in such projects.

Before entering into contracts for such participation, the bill directs the secretary to inform all members of the House Interior and Insular Affairs Committee of the proposed transaction. The committee will then be in a position to fully consider any controversal proposition before final federal approval is given.

Hoover Dam Addition

Finishing touches are being made to Hoover Dam with the installation of 104,500-kw generator on the Nevada side of the Colorado River. The new unit is being installed to meet extra energy requests of Los Angeles and Nevada, both of whom will bear the $5.5-million cost. Known as N-8, the new generating unit will provide the power project with its intended installed capacity of 1,354,300 kw.

TVA Budget Fight

Ike's 'no new starts' policy gains support as House unit fails to act on the pleas for continued power expansion

House economizers appeared set to hold Tennessee Valley Authority to the "no new starts" policy of President Eisenhower despite vigorous pleas for continued power expansion.

With the testimony from TVA backers in last week, the House Appropriations subcommittee considering funds for the agency gave no indication it would go beyond the $120.9 million requested by the Administration. This amount would allow the authority to continue its work on the steam plants already under construction.

Predicts 'Brownout' . . . Tennessee Gov Frank C. Clement predicted the Republican policy would lead to a "brownout" in the valley and sought money to permit TVA to begin construction of the proposed 450,000-kw steam electric generating plant north of Memphis.

This made little impression on subcommittee members. However, some consideration was being given to a proposal by Republican Rep Charles R. Jonas of North Carolina for cutting TVA loose from all government appropriations.

Financing Proposal . . . The North Carolina Republican proposed that TVA obtain its money for power expansion from outside sources. Presumably he had in mind a government corporation setup to be financed through sale of revenue bonds. Whether TVA's present electric facilities, which are mostly financed by federal government appropriations, would be available as collateral under Representative Jonas' plan was not disclosed.

Vote on Amendment Possible . . . It was barely possible that the House might have a chance to consider the proposal made by Representative Jonas in the form of an amendment to the TVA funds bill.

But the proposal would be sure to run into unremitting opposition in the Senate even if it survived a House vote.

Two Dams on Middle Snake . . .

. . . proposed by Bureau of Reclamation to Congress. Plan calls for dams at Mountain Sheep and Pittsburg Landing

While hearings before Federal Power Commission on Idaho Power Co's application for a license to develop the power potential of the Hells Canyon stretch of the Snake River drone on, preliminary studies are being made on downstream developments.

The Army Corps of Engineers and Bureau of Reclamation have just reported to the Senate Public Works Committee their ideas for development—ideas that would add more than 1.4 kw of hydro power.

Shift in Position . . . Preliminary findings in the Reclamation report indicate a shift from the previously proposed high dam at Mountain Sheep to a two-dam plan—a low one at Mountain Sheep and a higher arch dam near Pittsburg Landing 20 miles upstream.

These dams together would develop the 560-ft head of the 50-mile stretch, formerly contemplated for the single high Mountain Sheep dam.

Reclamation turned around on its Mountain Sheep one-dam proposal after additional drilling and tunneling of the two abutments and interpretation of site data by geologists showed that construction of a high dam would cost more than previously estimated.

Advantages . . . Further examination of potential sites near Pittsburg Landing pointed strongly toward a two-dam plan as having superior economic and engineering feasibility, the regional office found. But it makes clear that evaluation of the plan will require foundation exploration and design studies as extensive as those made for the Mountain Sheep site.

This proviso points up the fact that the report is merely for interim information of Congress. At this stage, it carries no official endorsement of Reclamation or Interior.

Plans for the two-dam concept assume development of Hells Canyon itself, with either three low dams or a single high dam. Federal Power Commission hearings are moving gradually toward a decision on Idaho Power application for run-of-the-river plants at the Hells Canyon and Oxbow sites, with a third at Brownlee site.

The Projects . . . The proposal includes a gravity dam and power plant at Mountain Sheep to develop about 158 ft of hydraulic head and an arch dam with power plant at or near the so-called Pleasant Valley site to develop an additional 402 ft of head.

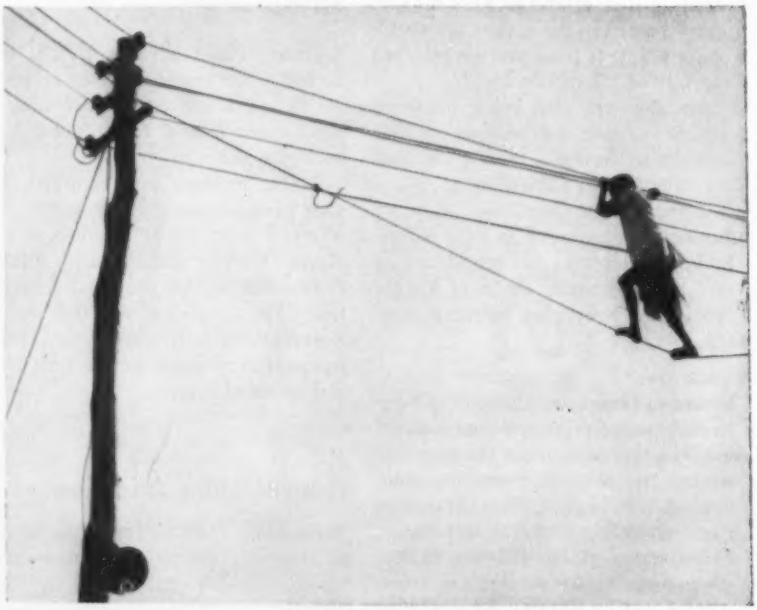
With 1 million acre-ft of storage capacity upstream, the power installation under the two-dam plan would be 880,000 kw—630,000 at Pleasant Valley and 250,000 at Mountain Sheep. With 3,880,000 acre-ft of upstream storage capacity, the two-dam power installation would total 1,020,000 kw made up of 720,000 kw at upper site and 300,000 at lower.

With the Reclamation regional office document, the Corps of Engineers sent to Congress a report by its district and division engineers on investigations of the Snake River and tributaries above Lewiston, Idaho. This report—still to be cleared by the Board of Engineers for Rivers and Harbors before being considered for formal recommendation by the Chief of Engineers—speaks favorably of two large multipurpose projects on the forks of the Clearwater River.

Clearwater Sites . . . The two projects would have a total power installation of 532,000 kw. Sites recommended by the reporting Army Engineers officers are at Bruces Eddy on the north fork of the Clearwater River and at Penny Cliffs on the middle fork of the river.

Bruces Eddy project calls for a 570-ft dam and a power installation of 240,000 kw. Usable storage would be 1,433,000 acres ft. Cost is estimated at $117.5 million.

Penny Cliffs project would cost $191.7 million. A dam 590 ft high would impound 2.3 million acre ft of usable storage. Power installation would be 292,000 kw.



Getting Out of Harm's Way

While 500 Indian people were being crushed to death during the recent stampede of pilgrims at Allahabad, India, this boy got up where it was "safe." He climbed the pole at left, worked his way out on the wire and clung to his perch long after the disaster, in which another 1,000 were injured. Police had to bring him down by ladder. He lost consciousness after the rescue, but lived to talk about it later.

Clark Hill Ruling . . .

. . . on power distribution expected following meeting of Interior, co-op officials

Interior Department was believed moving toward a showdown late last week on a contract for the sale of Georgia's share of power from the federally owned Clark Hill Dam.

Most recent development was a meeting between Interior officials and representatives of 37 rural electric cooperatives in Georgia to discuss Interior's plan for disposing of the power.

It was expected that the co-op leaders would be given an opportunity to express their views of the Interior proposal. If they did not approve, it was likely they would be asked to come up with a firm and workable alternative.

Issue in Doubt . . . Observers of the long-drawn-out negotiations for the disposal of Clark Hill power in Georgia would not guess as to the contents of the Interior proposal. However, they believed the department was intent on getting the matter out of the way before the end of the month.

Disposal of the power in Georgia was among the more touchy power policy problems inherited from the Democratic Administration last year. Its national political implications have been such that Interior Secretary Douglas McKay once remarked that it would be discussed at cabinet level before a decision was reached.

Transmission and sale of the power from this project is significant only if it marks some change from procedures now in practice. Electric utility men are keeping their eyes on the situation to see how the new Administration interprets the preference clause.

Wheeling Refused . . . Georgia Power Co, which owns the only transmission lines suitable for Clark Hill power, has adamantly refused to enter into any "wheeling" contracts. It proposes instead to purchase the entire output of federally produced power, firm it up with its own generation, and sell it to the preference customers at minimum rates.

Under its proposals, Interior would be able to designate the preference customers eligible and apportion the federal power among them. Chief aim of the proposal is to permit the company to keep its customers.

This contract was turned down flatly by former Interior Secretary Oscar L. Chapman on the grounds that it was not compatible with the Flood Control Law and especially the preference clause.

Electric co-ops have also strongly protested the proposed power company contract and retained former Georgia Gov Ellis Arnall to fight their case.

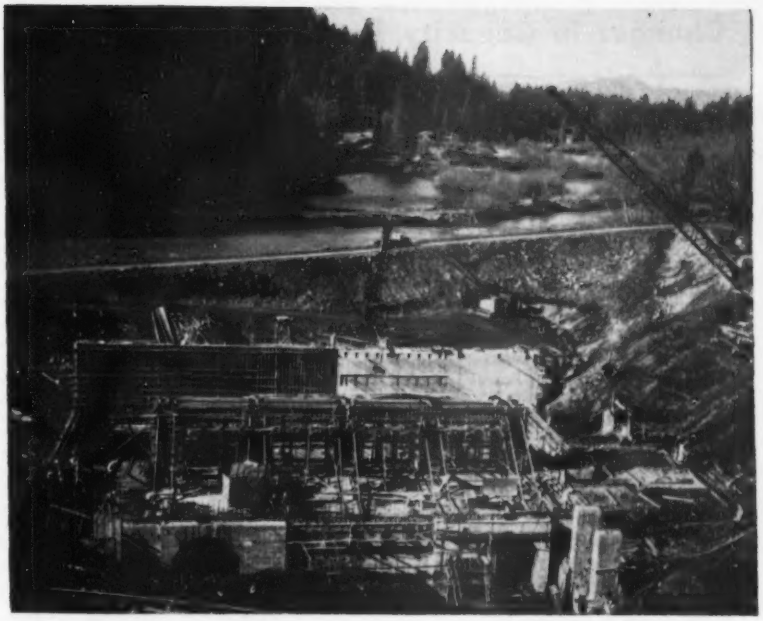
Co-ops Have Alternative . . . As an alternative, the co-ops have proposed that they be permitted to purchase the entire Georgia share of Clark Hill output, then contract with Georgia Power to transmit it for them. The company has declined to enter into negotiations on this proposal.

Another alternative discussed is that the federal government build transmission lines to serve preference customers in the area. But Congress, even under Democratic majorities, has refused to appropriate funds for federal transmission lines in the Southeast.

First power from the Clark Hill project went on the line last year. At the present time there is approximately 82,000 kw of installed capacity at the project. Half the output is apportioned to South Carolina and half to Georgia.

Preference customers in South Carolina have built transmission lines to carry their own share of the power.

The Georgia share of Clark Hill power is now being disposed of under an interim contract to Georgia Power Co. This contract has been on a month-to-month basis and the company has made it known that it will not continue it much longer.



Another Powerhouse for the Pit River

The form of a powerhouse which will generate 84,000 kw of electricity emerges in concrete and steel beside the Pit River, which has been shunted aside with a coffer dam while construction progresses. The plant is Pacific Gas & Electric Company's Pit 4 Powerhouse in northern California to which water will be diverted through a 4-mile tunnel. The $25-million project is scheduled for completion next year.

REA Interest Rise Denied

President Eisenhower this month denied that the government intended to increase the interest rate on rural electrical loans. He labeled as rumors reports that the government would seek to raise the loan rate from 2% to 2¾%. Rural Electrification Administration interest rate is set by law.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING DECEMBER

State	Utility	Plant	Fuel	Capacity (Kw)
Vt.	Central Vermont Public Service	Gas Turbine	S	5,000
Conn.	Connecticut Light & Power	Danielson	S	5,000
N. Y.	New York State Electric & Gas	Greenridge	S	100,000
Ohio	Cleveland Electric Illuminating	Eastlake	S	100,000
Ohio	Ohio Power	Muskingum	S	175,750
Ind.	Public Service Co of Indiana	Wabash River	S	90,000
Ind.	Indianapolis Power & Light	White River	S	60,000
Ill.	Rantoul Municipal Light & Water	Rantoul	IC	1,233
Ill.	Commonwealth Edison	Ridgeland	S	150,000
Minn.	Otter Tail Power	Bemidji	IC	3,400
Minn.	Rochester Electric Light Department	Silver Lake	S	11,500
Mo.	Albany Light & Water Department	Albany	IC	765
N. D.	Montana-Dakota Power	Williston	IC	8,000
Kan.	Western Light & Telephone	A. Mullergren	S	15,000
Va.	Corps of Engineers	J. H. Kerr	H	32,000
Va.	Appalachian Electric Power	Kanawha River	S	175,750
N. C.	Duke Power	Buck	S	125,000
S. C.	South Carolina Public Service Authority	Pinopolis	S	40,000
S. C.	South Carolina Generating	Urquhart	S	75,000
Tenn.	Tennessee Valley Authority	Ft. Patrick Henry	H	18,000
Miss.	Mississippi Power & Light	Delta	S	99,000
Tex.	Houston Lighting & Power	Greens Bayou	S	100,000
Mont.	Bureau of Reclamation	Canyon Ferry	H	16,667
Colo.	Public Service Co of Colorado	Alamosa	S	10,000
N. M.	Public Service Co of New Mexico	Person	S	20,000
Wash.	Corps of Engineers	McNary	H	140,000
Ore.	Corps of Engineers	Detroit	H	100,000
Calif.	Imperial Irrigation District	Drop No. 2	H	10,000

PLANT RETIREMENTS DURING DECEMBER

R. I.	Narragansett Electric	Manchester	S	15,000
N. Y.	Niagara Mohawk Power	Bingham Mills	H	480
Mich.	Grand Haven Board of Public Works	Grand Haven	IC	800
Wis.	Wisconsin Power & Light	Wittenberg	H	100
Mo.	Missouri Public Service	Warrensburg	IC	252
Va.	Virginia Polytechnic Institute Heat & Power Plant	Blacksburg	S	2,000
Ga.	Georgia Power	Columbus	S	7,500
Ga.	Georgia Power	Blakely	IC	470
Fla.	Bartow Municipal Light & Water Department	Bartow	S	3,820
Miss.	Mississippi Power & Light	Fernwood	S	2,250
Miss.	Mississippi Power & Light	Jackson	S	4,500
Miss.	Mississippi Power & Light	Charleston	IC	136
Tex.	Southwestern Gas & Electric	Marshall	S	2,500
Calif.	Pacific Gas & Electric	Station "A" San Francisco	S	15,000
Calif.	California Oregon Power	Trinity Center	IC	50

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of Jan. 1—Hydro, 21,993,733 kw; Internal Combustion, 2,160,777 kw; Steam, 67,264,587 kw; Total, 91,419,097 kw.

Delinquent REA Accounts Dip to Nine-Year Low

Overdue electric loans to Rural Electrification Administration were down to the lowest point in nine years at the beginning of 1954.

The agency reports it had only 12 delinquent accounts for construction loans and ten for consumer facilities. This compares with 25 delinquent construction borrowers a year earlier and 19 borrowers for consumer facilities.

On the other side of the picture, more than 700 REA borrowers are well ahead of schedule on repayments. Advance payments to REA totalled about $10 million for 1953, bringing the 15-year cumulative total to more than $62.5 million. This compares favorably with the total amount due as payments on interest and principle from all electric borrowers for the year of 1953.

Moneywise the overdue payments amounted to $250,078 on the construction loans and $93,274 on consumer facilities loans. Total overdue amount of $343,352 was the lowest since 1944, REA said.

Loan payments are counted overdue when they run more than 30 days behind schedule.

Senate Allots $3 Million for 'Quoddy Project Study

Congress is taking another look at the oft-proposed Passamaquoddy tidal power project off the coast of Maine.

The Senate recently voted to appropriate $3 million for another survey of the controversial power project. The measure is now before the House for Congressional approval.

Plan generally is to harness the tidal fall in the Bay of Fundy by putting a power plant between the incoming and outgoing tides. Government figures back in 1941 put the overall cost of the project at about $90 million and estimated the project would be capable of delivering 110,000 kw at a 60% load factor.

In a study submitted to Congress 13 years ago, Federal Power Commission concluded the proposed tidal power project "cannot compete successfully at this time with river hydroelectric power potentially available in the state of Maine, or with power from modern efficient steam-electric plants."

POWER BRIEFS

● Mountain States Power Co intends to challenge the right of Eugene (Ore.) Water & Electric Board to extend its service area outside city limits by condemnation of neighboring private utility property under the city system's charter. This was reported by Robert Sipe, MSP's Willamette division manager, in a recent public discussion of the issue before the Eugene Real Estate Board.

● Bureau of the Budget has authorized the publication of a monthly digest-size magazine entitled "Rural Lines" by the Rural Electrification Administration. Publication is to begin in May. Mrs Marguerite Hedge has been named editor of the magazine.

● First unit of Tennessee Valley Authority's $213-million Kingston steam plant has been placed in commercial operation. The unit has a capacity of 150,000 kw.

● Central Maine Power Co's construction plans call for installation of a 30,000-kw generator at its Mason steam plant in Wiscasset which will boost plant capacity to 130,000 kw.

ENGINEERING MEETING

Distribution Criteria Needed . . .

. . . to compare performance of different designs, EEI T&D committee told. Circuit faults, aluminum sheath discussed

Establishment of an acceptable measure for distribution performance was urged by C. J. Beller, Cleveland Electric Illuminating Co, upon members of Edison Electric Institute's Transmission and Distribution Committee at Cleveland, Feb. 9 and 10. He suggested "faults per year per 100 circuit mile" as a suitable criterion. When performance of different designs can be compared, investment and operating cost can be evaluated to determine the best, he said.

Beller characterized the seven-year study just completed by the Edison Electric Institute-American Institute of Electrical Engineers joint working group on coordination of construction and protection of distribution circuits as "only a small start." Volume of data was too small to be conclusive, he said, yet IBM processes were required to summarize it. He inferred that much more work should be done.

Circuit Faults . . . Urgent need for much faster clearing of distribution circuit faults was stressed by several speakers. Times as short as one cycle were mentioned. Conclusions of tests staged by Public Service Electric & Gas Co, R. M. Havourd were:

1. Covered wire 2/0 and larger probably will not burn down in 3 to 5 cycles at 3,000 amp or less. But arc burns may cut current capability.

2. Covered wire No. 1 and smaller is severely damaged by current over 700 amp in 3 to 5 cycles.

3. Fault clearing in one cycle restricts damage to tolerable condition.

4. Aside from fuses, only reclosers can clear in one cycle and these are not large enough for the job.

W. R. Bullard, Ebasco Services, advocated committee search for faster circuit breakers. One-cycle clearing is badly needed, he said.

Aerial Cable . . . Greater use of aerial cable to improve the reliability of overhead lines was advocated by G. J. Crowdes, Simplex Wire & Cable Co. Additional advantages are savings in tree trimming and rights of way costs. He described installation methods and design data for: Messenger and ring supported cable, self-supporting cable and spinner-lashed cable.

Tentative IPCEA specifications for aerial cable were presented by D. A. Silver, General Cable Corp. Three types of rubber insulated copper cable are covered, for voltages to 15,000. And standardization of supporting bare neutrals is included.

Self-supporting rubber-insulated cable is customary at 5 kv, reported R. C. Waldron, Okonite Co. Use of aerial cable has doubled in five years, he said, largely for distribution. But paper insulated cable is popular at 15 kv, and low pressure gas cable offers advantages above 15 kv.

Experience gained from installing 25,000 ft of 12-kv rubber insulated armored cable was reported by E. R. Streed, Delaware Power & Light Co. This cable was factory-assembled on Copperweld messenger. Aerial cable with aluminum conductors has been adopted recently for distribution secondaries and service drops. A total of 430,000 ft is in service. A proposed installation for Boston Edison reviewed by Edward Rue shows 30% savings in weight when aluminum replaces the lead sheath of 3/c 350 mcm 15-kv aerial cable. Conversion of conductors to aluminum decreases weight another 20%. A polyethylene protective jacket is provided.

Savings Cited . . . Aluminum sheaths will permit higher pressure paper cable with "very large savings," reported W. A. Del Mar and E. J. Merrell, Phelps Dodge Copper Products Corp. Wiping of joints has been solved, and a polyethylene jacket protects against corrosion, they said.

Reduction from 2.6 to 1.2 lb per ft for 1/c 500 mcm 27-kv cable makes aluminum sheath attractive for underground use, said T. C. Duncan, Consolidated Edison Co of N. Y. Pulling stress is lower and handling easier.

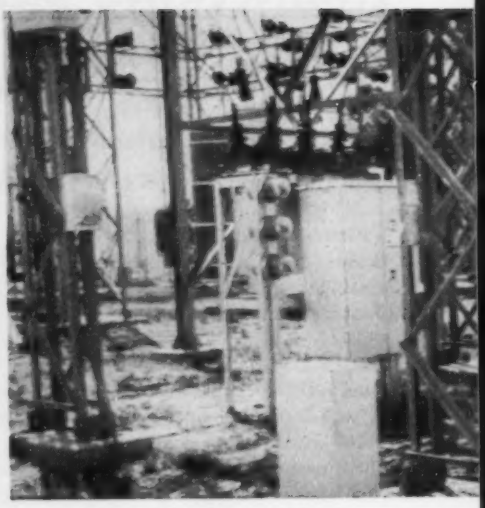
Cable trouble rate for 16,669 miles above 7.5 kv was 7.5 per 100 mile for 1952, slightly lower than 1951, reported H. L. Davis, Jr, Philadelphia Electric Co. Mechanical damage is principal cause, he found, with cable movement an outstanding contributor.

EXAMINING SPECIMENS of aluminum-sheathed cable at EEI Transmission and Distribution Committee meeting are (l to r) T. C. Duncan, Consolidated Edison; D. C. Hawley, Kansas City G&E; Edward Rue, Boston Edison; and E. J. Merrell, Phelps Dodge Copper Products. In right panel are G. B. Dodds, Duquesne Light; C. J. Beller, Cleveland Electric Illuminating; L. L. Carter, Anaconda

METER SOCKETS are installed on a 6-in. steel channel, 9 ft long, which is set 3 ft in the ground. There are three sockets on each side of the channel. Pictured are three ammeters

Metering Aids Expansion

New socket-type instrument techniques assist Southwestern G&E in anticipating and building system to meet rapidly expanding loads



THREE DEMAND AMMETERS are installed on each of two circuits. On right channel volt-

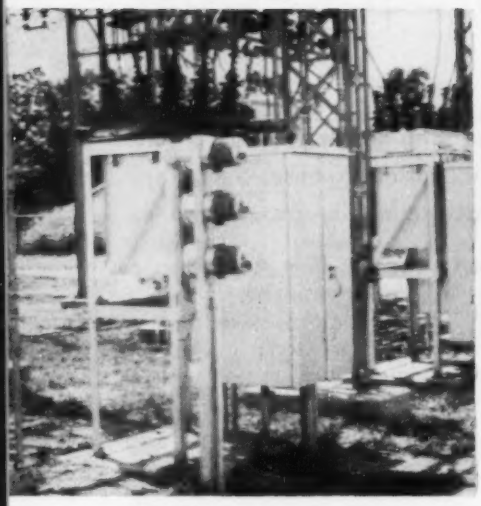
W. C. MORRIS, JR, Assistant Division Engineer, Southwestern Gas & Electric Co, Shreveport, La.

New metering techniques today provide the Southwestern Gas & Electric Co, Shreveport, La., with load data for expanding facilities to meet a once serious overload problem. Reactive load, once particularly troublesome, is now recorded through the new metering procedure. Southwestern can now make the proper provisions for rapid load growth and fast-changing load characteristics.

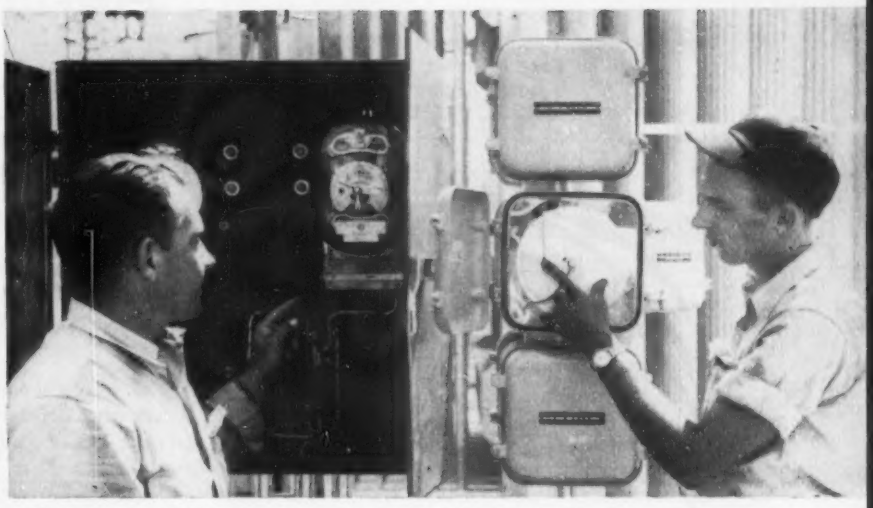
Results obtained with recently installed metering equipment enable the company to keep up with kilowatt and kilovar loads, voltage conditions, circuit balance, and power factor. Southwestern now anticipates trends in these changing factors and applies its new data to both design and operation.

Old Information Incomplete . . . Formerly, each distribution circuit was equipped with a thermal ammeter and a recording combination kilowatt hour-kilowatt demand meter. These instruments were mounted on the relay panel and connected to the relay current transformers. Reactive loads were not metered.

Information for capacitor application was obtained by cutting into the relay circuits. The application of time clock switched capacitors, however, demanded more data and more



meter with max-min indicators is back to back with ammeter on top phase of circuit



KILOWATT AND KILOVAR demand meters are installed back to back on the same channel. The weatherproof box houses permanent kilowatt-hour meter, test switches, recording voltmeter

precise information than was obtainable. In general, Southwestern's metering had not kept pace with fast-changing load conditions; so the company lacked information for expanding facilities to meet requirements.

To obtain adequate load information quickly several types of meters were purchased:

1. Combination indicating and thermal demand ammeters, ADS type, to show what load has been on.

2. Recording demand ammeters, CCA type, to tell what load was on and when it was on.

3. Recording var meters.

4. Thermal voltmeters with maximum-minimum indicators.

5. Demand meters, CCW type, to indicate maximum kilowatt demand.

All are thermal instruments of the socket type for which sockets have been installed in all substations. Any of the meters can be installed in any of the sockets by simply plugging in, and the sockets are wired to the circuits to be metered. As changing meters requires no wiring changes, one source of error is eliminated.

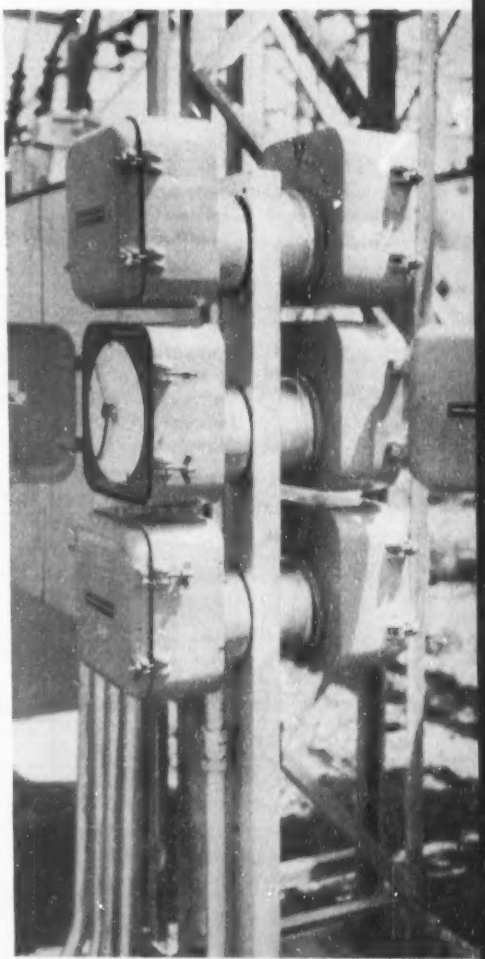
For Complete Load Information . . . To plug in two sets of meters on the circuit at the same time, two sockets are mounted back to back and wired to the same phase of the circuit. This type of installation permits correlation of var with kilowatt data and determination of power factor at maximum and minimum load.

Some reactive demand meters have two-day and some eight-day charts, and both types have raised zero for determining switching times. These meters provide data for the installation and switching of capacitors. They also give seasonal information, such as is required to obviate high voltage conditions likely to occur during winter months. Kilowatt demand meters are of the two-day type.

The initial purchase of instruments was sufficient for metering all circuits on one substation. The Shreveport division has 24 stations. Results from this equipment prompted further purchases, and there is a sufficient number of ammeters now to meter a third of the substations.

Just a Three-Week Job . . . Meters stay at a substation two days and are then delivered to a new location. All circuits in the division can be metered in three weeks. Three ammeters on each circuit and one voltmeter for each bus remain permanently at each station for continuous checks. From these, balance conditions and regulator range are determined.

The permanent kilowatt hour-kilowatt demand meter used is a standard 3-phase, 4-wire, 2.5-amp, 120-v, type A meter, which is a stock item. As sockct mountings are an advantage only when meters are charged frequently, the type A meter is mounted permanently in a weatherproof box having test switches.



REACTIVE AND KILOWATT demand meters in paired sockets correlate kvar and kw data

Aerial Cable Cost

Extra load carrying ability pays for a considerable part of increased expense. Better appearance and service reliability are advantages

F. C. VAN WORMER and H. M. BANKUS
Electrical Utility Engineering Section
General Electric Co,
Schenectady, N. Y.

The real economics of aerial cable become more apparent when compared with open wire on the basis of dollars per kva of load area coverage instead of on the cost per mile of line.

This point is often overlooked while emphasis is being placed on the more obvious advantages of improved appearance, greater reliability, and reduced tree trimming.

When open-wire construction costs are compared with those for aerial cable, mile for mile the aerial cable costs from 50 to 150% more, the exact percentage figure depending on local conditions and what items are included in the total outlay.

But such a comparison leaves unrevealed an important part of the economic picture. It fails to take into account the greater load carrying ability of aerial cable construction on voltage limited circuits. The includes the majority of primary distribution feeders.

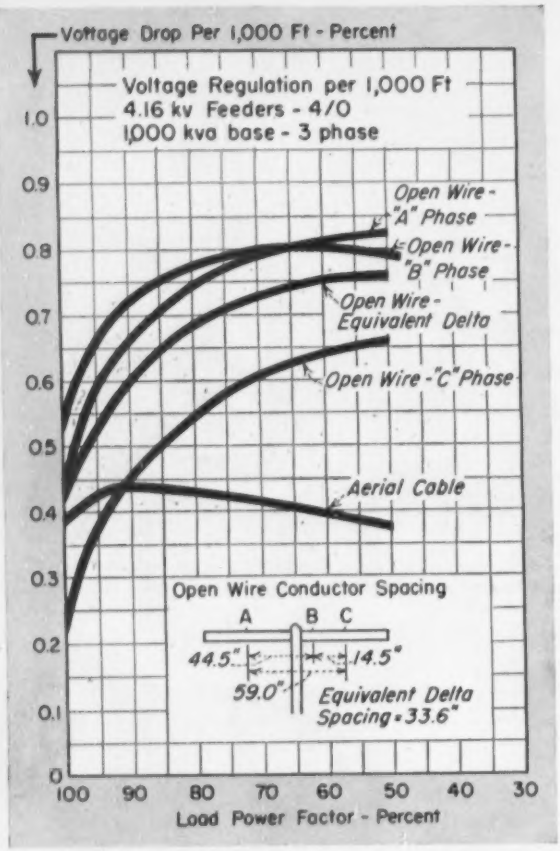


FIG 1—VOLTAGE DROP in aerial cable and in open-wire of corresponding sizes is chartered as a function of load power factor

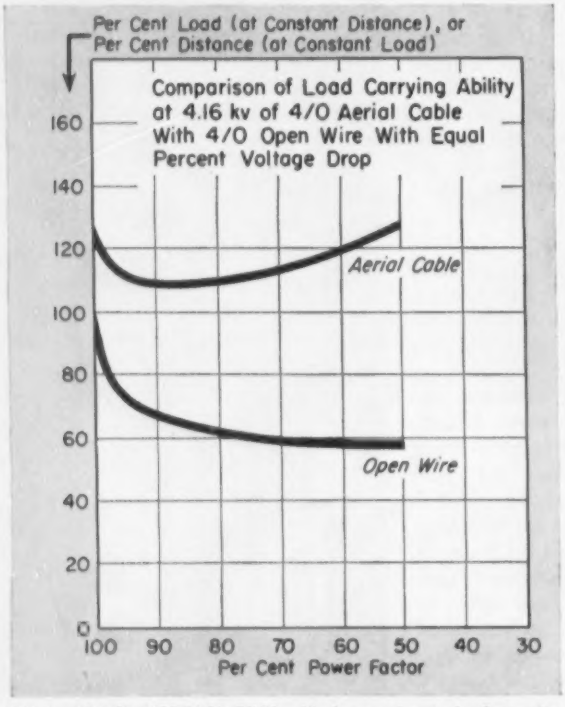


FIG 2—LOWER VOLTAGE DROP affords an edge in load carrying ability. Load and distance are shown as functions of power factor

Cable Size Important . . . Much of the voltage drop in an open-wire feeder is the result of line reactance. The ratio of reactance to resistance increases directly with conductor size and spacing. For a 4/0 open-wire line with an equivalent delta spacing of 33.6 in., a conductor size representative of the construction often used on 4-kv primary feeder mains, the ratio is about 2-1.

It is not customary to transpose the phase conductors on primary circuits. Hence, the reactance and effective resistance, and consequently the voltage drop in the line, is different for each phase. The limiting load on a voltage-limited circuit is determined by the voltage drop in the phase with the greatest impedance.

Fig 1 shows the spread in voltage drop in the various phases of a 4-kv feeder with 4/0 open-wire conductor as a function of the load power factor.

Voltage Regulation Better . . . The conductors of a 3-phase aerial cable are closely grouped in equilateral triangular formation. This arrangement results in balanced reactances much lower in value than those obtained with open-wire construction. This improves voltage regulation.

For the larger conductor sizes the resistance is low, and the reactance becomes a considerable part of the circuit impedance. Thus aerial cable becomes more advantageous as the conductor size increases.

Fig 1 also shows a comparison of the voltage drop in 4/0 aerial cable feeders with the voltage drop in 4/0 open-wire feeders. Thus, it is shown graphically that aerial cable becomes more advantageous as the load power factor decreases.

Can Be Justified

Load Carrying Greater . . . Fig 2 illustrates the greater load carrying ability of aerial cable for voltage limited feeders. Aerial cable's lower voltage drop will carry the same load farther, or greater load the same distance.

Power factor affects the load carrying ability of aerial cable less than it does that of open-wire. In fact, the load that can be carried via aerial cable increases as the power factor drops below about 85%.

Some newer residential loads coming on power systems today have a very low power factor. As this trend continues, the greater load capability of aerial cable should prove even more important in the future.

Best Application . . . Three-phase primary mains afford the most attractive application of aerial cable. On these, the largest conductor sizes are used and, consequently, in this usage lies the greatest opportunity to increase feeder load carrying capability. Other advantages of aerial cable take on importance in this field.

Service reliability is most critical on the mains. An outage here affects all or most of the customers on a feeder, while an outage on a single-phase lateral affects only a relatively few customers.

Tree-trimming expense is greatest where large space is required for open-wire, 3-phase cricuits. Trees must be trimmed around aerial cable, but the amount of trimming is greatly reduced. Aerial cable used for primary mains has an attractive appearance and relieves congestion on lines carrying more than one feeder.

An important consideration for any utility company is the fact that aerial cable reduces the chances of trouble spreading from feeder to feeder.

Economic Comparison . . . The theoretical square load area in Fig 3 was used in the economic comparison of aerial cable vs open-wire construction for 3-phase primary mains. Dimension "a" (hence the size of the load area) is allowed to vary to the extent that total voltage drop from the feed point to the end of the last laeral is 3%. Each main feeds a riangular load area such as that represented by points ABC.

Obviously, since the voltage drop in aerial cable is less than that for corresponding sizes of open-wire construction, the length of the main, dimension "a," is greater for aerial cable for the same voltage drop. Hence an aerial cable feeder main serves more area and picks up at constant load density more load than a corresponding open-wire feeder main.

To see the effect of the extra load carrying ability of aerial cable, the economic performance of a distribution system using aerial cable mains should be compared with a system using open-wire mains on the basis of dollars per kva of load area coverage.

Costs Nearly Equal . . . If 4-kv, 3-phase, 4/0 aerial cable mains cost $17,800 per mile and the corresponding open-wire construction $7,800 per mile, the ratio of these costs is 228%. Such a difference is conservative. These costs do not include tree-trimming expenditures.

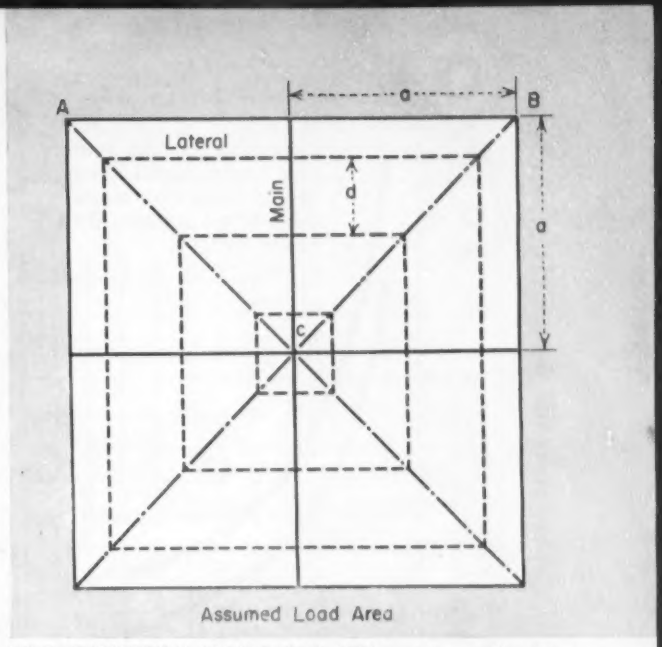


FIG 3—THEORETICAL SQUARE LOAD AREA must be considered in economic comparisons of aerial cable with open-wire 3-phase primary

Single-phase, 4-kv, No. 4 open-wire laterals are assumed to cost $3,900 per mile. Fig 4, based on these figures, shows the total costs of primary lines in dollars per kva as functions of load density at 90% power factor.

Instead of costing 128% more than open-wire construction on a per mile basis, aerial cable now costs only from 25% to 37% more in dollars per kva, depending upon load density. If the ratio of these costs is less than the assumed 228%, the differential shown in Fig 4 would be reduced and could even disappear. When the difference in tree-trimming costs is factored in, this differential is further reduced.

Other Savings . . . Primary lines are not the only places where costs are affected by the use of aerial cable mains. The increase in size of the load area when aerial cable is used, load density remaining constant, allows the use of larger substations. These cost less in dollars per kva, and fewer of them are required to cover a given area. Fig 5 shows the effect of the inclusion of the substation factor in the costs plotted in Fig 4.

Substation costs are based on using package type unit substations arranged for radial feeders and multiple subtransmission. The substations are assumed to be rated 34.5 kv high voltage to 4.16 kv low voltage with load ratio control on the low voltage side. Substation rating varies with load density and load area size, but sizes have been picked to conform to standard ASA unit substation kva ratings.

An overload of 10% was allowed in accordance with ASA guides for transformer loading and an arbitrary limit of 2,000 kva per feeder was assumed. Either two or four breaker positions were provided as required by the total kva in the load area served. When two breaker positions are provided, each serves two of the triangular load areas shown in Fig 3, with the feeder bifurcated on the load side of the breaker.

The break in the open-wire curve in Fig 5 at 6,000 kva per sq mi indicates the point where it was necessary

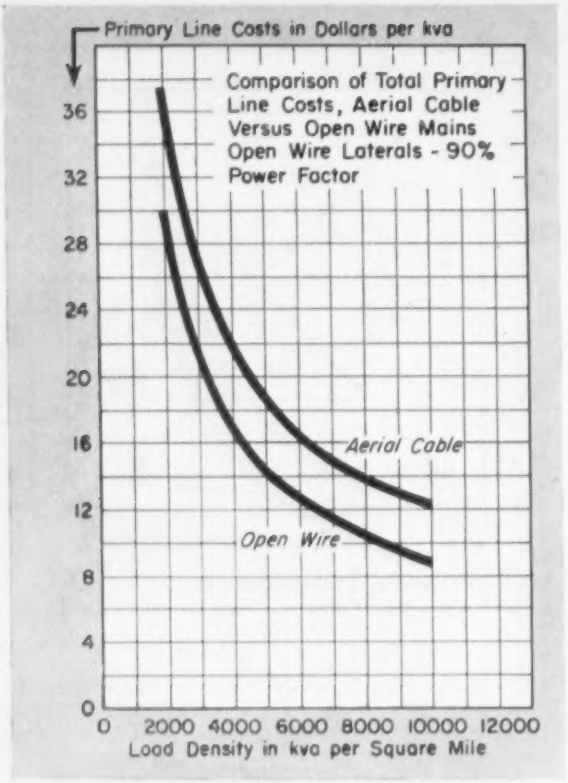


FIG 4—TOTAL COSTS of primary lines in dollars per kva are functions of load density when a 90% power factor is assumed constant

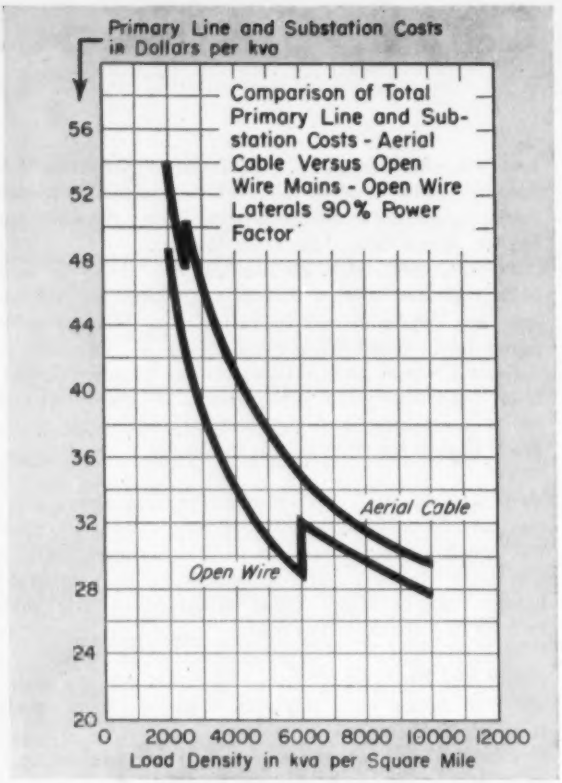


FIG 5—SUBSTATION COSTS are correlated with total expenditures for primary lines in dollars per kva, and breaker positions are provided

to change from two feeder breakers to four per substation to avoid exceeding the limit of 2,000 kva per feeder. A similar break occurs in the aerial cable curve at 2,500 per sq mi.

Load Density Factor . . . The total cost per kva of serving a load area, Fig 5 indicates, varies greatly depending upon load density. The number of feeder breaker positions required in the substation materially affects total costs as well as the difference in costs between open-wire and aerial cable construction. The number of breakers required in an actual system is determined by the total load served and the distribution of the load within the load area. The percentage difference in costs of aerial cable and open-wire drops to a minimum of 7.2% when substation costs are included in the calculation.

Total distribution costs have not been included, only costs affected by use of aerial cable or open-wire mains having been considered. When the outlay for distribution transformers, secondaries, services, and meters are part of total costs, the percentage differential is considerably less.

Subtransmission Costs Not Considered . . . Subtransmission costs have not been factored into the comparison. These too would favor aerial cable mains because fewer substations could serve a load area and fewer miles of subtransmission lines would be required.

Real estate costs were ignored because of the tremendous variation in land values by location. But, obviously, where fewer sites are required, real estate expenditures on the average are lower. Here is another factor favoring aerial cable.

All costs in Figs 4 and 5 include capitalized losses. These were evaluated at $375 per kw for core loss and $250 per kw for copper loss. A lower copper loss would lean to the larger size load area and aerial cable.

Competitive Position . . . Aerial cable can compete with open-wire construction in areas where it can use its greater load carrying ability to advantage. Where local costs are low, the cost ratio drops below that assumed in the calculations, and the cost differential is considerably reduced. Then reliability, appearance, service continuity, and the tree-trimming element become the basis of comparison. These may justify the remaining cost differential.

This study was based on 4.16-kv distribution as this system is widely used and is quite vulnerable to tree interference. Aerial cable is easily applied at 4.16 kv. Nonshielded cable may be used, and it is possible to "hot tap" this type of cable if "reverse lay" preassembled or field assembled construction is used.

Aerial cable for distribution feeders is not limited to 4.16 kv. It may also be used at 12 or 13.2 kv. At these voltage levels shielded cable is required, and this increases the difficulty of making taps. The advantages resulting from the extra load carrying ability of aerial cable are also present at the higher voltages. The method of economic comparison used at 4.16 kv may also be used to compare the performance of 12 kv aerial cable with open wire construction.

Protective Practices Cut BPA Costs

HAROLD L. RORDEN, Engineer of High Voltage Practices
RALPH S. GENS, System Planning Engineer
Bonneville Power Administration, Portland, Ore.

- **High speed automatic switching has replaced the use of the continuous overhead ground wire for protection against lightning.**
- **Insulation levels have been reduced for overhead lines and station equipment.**
- **Lightning arrester levels have been reduced.**
- **Large single-phase autotransformer banks have been installed.**
- **Spare single-phase transformers have been eliminated at major substations.**

New protective practices over the past ten years have reduced costs and improved efficiency of Bonneville Power Administration 230-kv transmission system. These measures will be applied, where practicable to BPA's 345-kv system now under construction.

Analysis of BPA's operating experience shows the paramount importance of the five practices set forth at the right.

While more applicable to higher voltage transmission, these five practices could be studied for use on lower voltages as well.

Towers Cost Less . . . While steel towers for the initial 230-kv lines were designed to support ground wires, newer lighter-weight towers have dispensed with them and, in fact cannot support them. Gaining confidence in automatic switching, BPA revised steel tower designs to effect a saving of 9-14% in weight.

For several years most lines in the lightning area have been reclosed automatically, average interruption time being less than 20 cycles. Automatic reclosing on an open-close-open cycle has proved so satisfactory that it is now preferred to use of continuous ground wires.

Formerly counterpoise had effectively reduced double-circuit and multi-phase flashovers. Though costly in mountainous areas, counterpoise was considered essential to a high standard of service. But success with high-speed automatic switching, coupled with system growth, has eliminated the counterpoise program.

Insulation on the first 230-kv structures, which were all of steel construction, consisted of 16 standard 5¾ x 10-in. suspension insulators without grading rings. BPA determines insulation levels on transmission lines by switching surges found by test in usual circumstances to be less than three times normal. Three-times normal voltage will determine the number of insulators capable of withstanding switching surges in rain, when two units are added to assure that lines with broken units remain in service.

It was found that only 11 standard 5¾ x 10-in. insulators are required on 230-kv steel tower lines, although to conform with safety codes 14 units are used on steel structures and 12 on wood pole lines. In one experimental area, 11 units have been in use on four consecutive steel structures for eight years. No flashovers attributable to low insulation level have occurred.

Number of Lines a Factor . . . The line insulation level within the ground wire area is an integral part of BPA's present protection scheme. If a single line terminates on a station bus, a lightning strike will cause the potential at the transformer terminals to increase because of reflection. Arresters may well prevent transformer or circuit breaker failure. For a lightning strike on one of two lines terminating on the bus, it is analytically possible for arresters to operate if attenuation of the traveling wave is neglected. In fact, attenuation and negative reflections reduce the traveling wave voltage below dangerous levels.

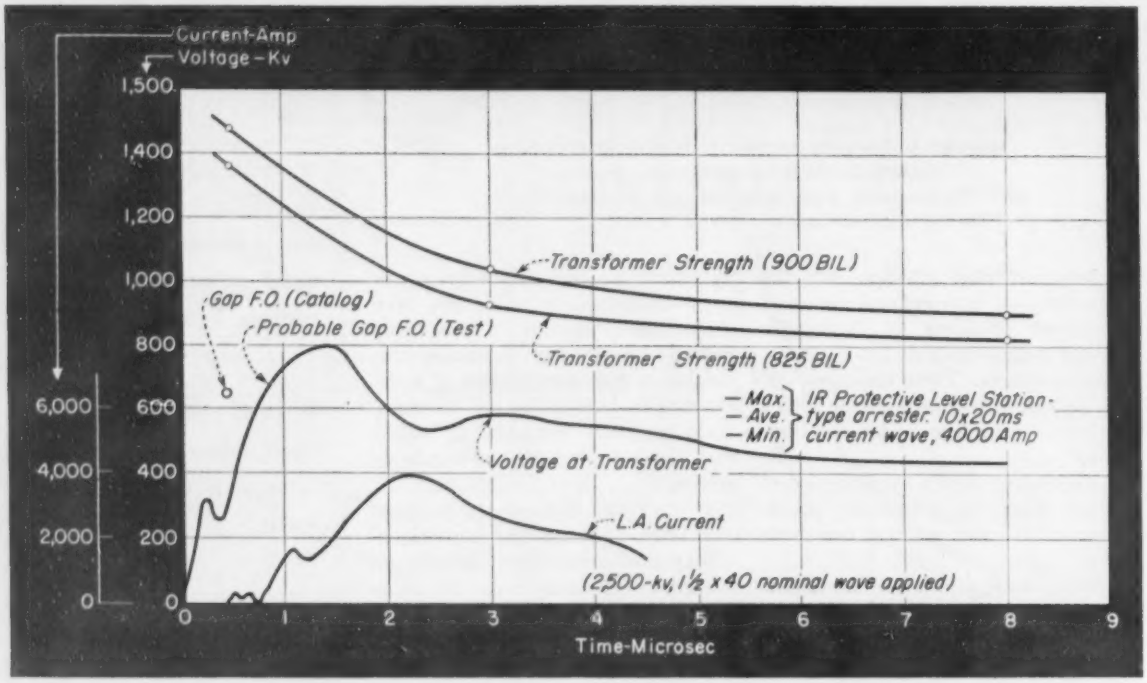
When a hit occurs a mile or farther away on one of three or more lines terminating on the bus, arresters will operate only in unusual circumstances. When one or more of these lines are relatively short, reflections may raise the potential level. Usually examination of each case is required to determine the need for arresters.

At present, with 17 lines on the Grand Coulee switchyard bus, traveling waves from hits a mile away cannot cause arresters to operate.

The Glenn H. Bell Substation at Spokane until recently had two 230-kv lines on the bus. During normal service, counters on arresters for each of four transformer banks never operated in more than ten years, even though there have been several direct lightning hits to lines within a few miles of the station. This station now has four 230-kv lines on the bus.

Grounding Is Over-Emphasized . . . It is BPA's belief that too much importance has been placed on the degree of grounding as it affects arrester performance and insulation levels on grounded neutral systems. Unbalance because of faults does not occur in voltages approaching levels dangerous to insulation. Therefore, these voltages are dangerous only to lightning arresters. But increasing arrester ratings to assure that failure cannot oc-

Based on the paper, "Protective Practices as a Criterion for High-Voltage Transmission Design," presented before the Winter General Meeting of the American Institute of Electrical Engineers at New York, Jan. 21, 1954.



CORRELATION between protective and insulation levels was obtained through tests on a 182-kv arrester which was located 22 circuit ft from a 230-kv, 900-kv transformer. An 825-kv BIL curve is included to demonstrate that the margin of protection afforded is adequate

BPA Correlates Protective and Insulation Levels by Test

cur involves higher BIL's. As the basic insulation level is the important cost item, increasing it means considerable expenditure to protect the protecting device.

Unbalanced fault voltages and voltages caused by overspeed due to load rejection are not likely to reach proportions that cause arresters to discharge. Nevertheless, such voltages may attain or exceed the arrester rating. AIEE standards require that 60-cycle gap flashover shall not be less than 1½ times the arrester rating. For 80% arresters this is more than double the normal system voltage. Below this value arresters do not operate.

Only in the more severe cases can voltages exceeding the arrester rating but not the gap flashover level cause arrester failure. Failure might also result from a voltage surge above gap flashover during the time the power frequency voltage is above the arrester rating. Usually this involves only one pole of the arrester. Such a remote possibility, according to BPA, does not justify a higher arrester rating or considerable expense for increased transformer insulation levels as assurance against arrester failure.

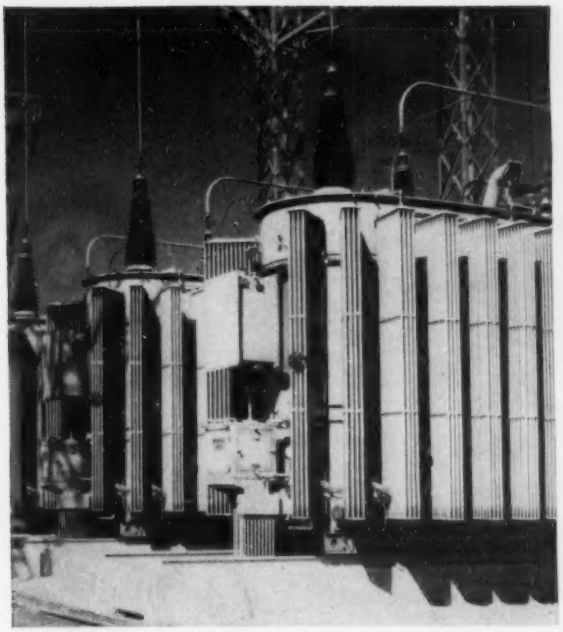
Ability to withstand power frequency voltages is a limiting factor in arrester applications. The arrester's surge protective level depends on the arrester rating. Thus, selection of an arrester to withstand a power frequency voltage determines the protective level. This in turn determines the minimum BIL to which equipment can be designed if coordinated with arrester protection. Because surges do not reach arrester discharge levels in many applications, predication of BIL's on arrester performance is not always necessary.

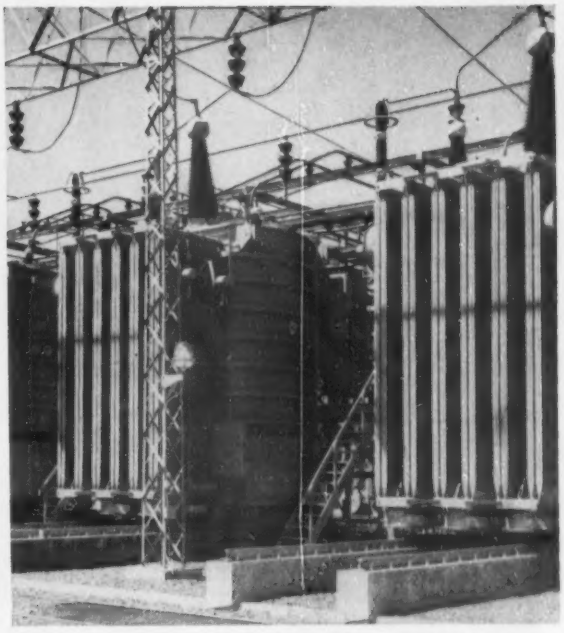
For proper coordination, BIL's should be predicated on application of the same test wave to arresters as to transformers. The user can then depend on protective margins for selecting a BIL for his system. In applying lightning arresters, the user has only 10x20 wave catalog data, usually given as averages of arrester performance. These data establish relative levels for comparative purposes and are adequate only where large margins separate protective levels and BIL's.

When insulation levels are closely engineered, 10x20 wave data are not realistic enough to provide levels indicative of the more severe surges that may occur. Predication of transformer BIL's on a 1½x40 voltage wave test and lightning arrester protective levels on a 10x20 current wave could produce a false sense of security.

How BIL's Are Selected . . . BPA selects BIL's by taking 20,000-amp average 10x20 wave station-type arrester protective levels as 5,000-amp levels for the steeper wave fronts expected. A 10% factor for conversion to steep front surges and a 7% stacking factor are added to average 5,000-amp levels. The average 20,000-amp level is about 17% higher than the 5,000-amp level. While steep front surges may exceed the 10% factor, traveling waves from a mile away are more nearly 3,000-3,500-amp maximum with usual 230-kv insulation levels. Thus BPA considers adequate the 10% factor above the 5,000-amp level.

Results of combined arrester and transformer tests conducted for BPA to determine the correlation between





IMPORTANT SIZE REDUCTIONS have followed BPA's use of lower equipment BIL's. Compare the bank on the left of 150,000/250,000-kva, 230/115-kv autotransformers (825-450-kv BIL) with 75,000/100,000-kva, 220/110-kv two-winding transformers (1,050-550-kv BIL)

Parallel Arresters Less Costly to Add Than Ground Wires

protective levels and insulation levels are shown in graph. These tests were applied to a 230-kv transformer having a 900-kv BIL and protected with a 182-kv lightning arrester 22 circuit-ft from the transformer bushing. The transformer successfully withstood usual ASA surge tests, equivalent to that shown for 900 BIL.

With an arrester connected to the test circuit to protect the transformer, twice the voltage used for the full wave test was applied. This potential could damage the transformer unless the arrester held the surge voltage below the transformer BIL. Arrester current and voltage at the transformer terminal are shown. An 825-kv BIL curve included for comparative purposes indicates an adequate margin of protection.

BPA May Use Parallel Arresters . . . Recent advances in lightning arrester performance suggest the possibility of economical direct-stroke arrester protection without an increase in BIL. Such usage would involve little risk of equipment failure. Arresters now available, for example, provide a maximum protective level of about 700 kv for 20,000 amp, 10x20 wave, for 182-kv rating, as used on BPA's 230-kv circuits. These arresters in parallel should provide protection against the more severe stroke currents up to 40,000 amp.

With a 10% added factor for steeper waves, the protective level is 770 kv, providing a 7% margin for 825 BIL. Steep front transformer test levels, as shown in chart, are 65% above the minimum BIL. Thus, a far greater margin really exists.

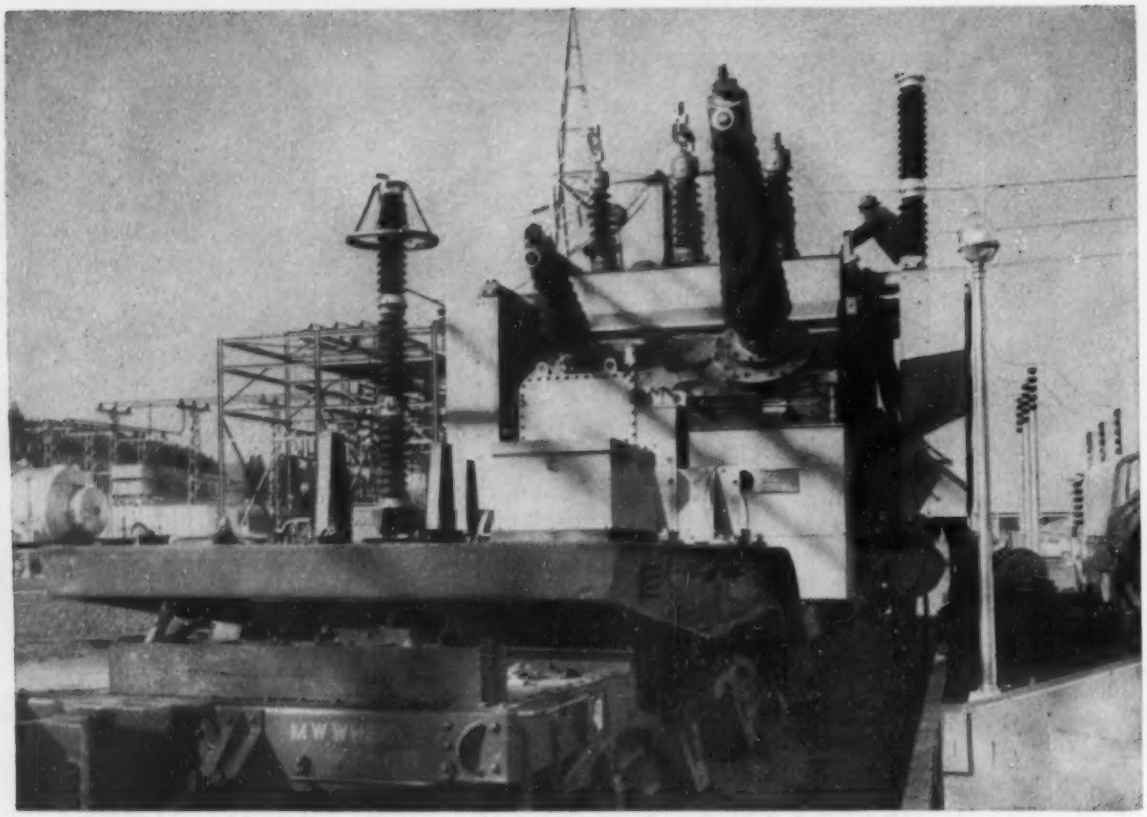
BPA system growth results frequently in placing substations near an existing transmission line and remote from ground wire protective zones. Where 230-kv lines cannot support ground wires, adding ground wire protection may involve removal and replacement of up to two miles of structures at an estimated cost of $65,000-$80,000. Additional installed cost of parallel arresters over three single poles is less than $10,000.

Need for removing the transmission circuit from service during the changeover period is also eliminated. While parallel arresters may not provide the full protection given by ground wires, the risk should be weighed against the relative cost and importance of the station. BPA will use parallel arresters when justified.

BILs Reduced in Two Steps . . . For the initial Bonneville system, major 230/115-kv transformer banks were rated 75,000-kva self-cooled with a supplementary 100,000-kva rating. These transformers were the conventional two-winding type, with a tertiary for low voltage loads or the addition of rotating reactive equipment.

Banks were purchased in single-phase units with one spare per station. They were protected with 80% lightning arresters located within 150 circuit-ft of transformer terminals. Transformers and circuit breakers had 1,050-kv BIL, and bushings and station bus insulation 900-kv BIL for 230-kv service.

A decade's experience with this equipment has suggested practices that have held the line or reduced cost without impairing reliable operation. Basic insulation levels for 230-kv service have been reduced 21% in two steps—from 1,050 to 900 to 825 kv—with commensurate reduction in



ELIMINATION OF SPARES at 11 major BPA substations is made possible by the use of mobile 83,333-kva, 220/13.2-kv single-phase unit which may be operated on railway car which transports it. BPA is one of few systems in country using such rail-car-mounted units

costs of transformers and circuit breakers. BIL's are still high, however, so that further reductions could effect worthwhile economies.

Opinions differ on the criterion for further reduction in BIL. One view holds that the ability of transformers to withstand power frequency voltages limits the basic impulse insulation level. Another view is that lightning is the limiting factor and insulation levels can be reduced when better protective margins are provided by lightning arresters.

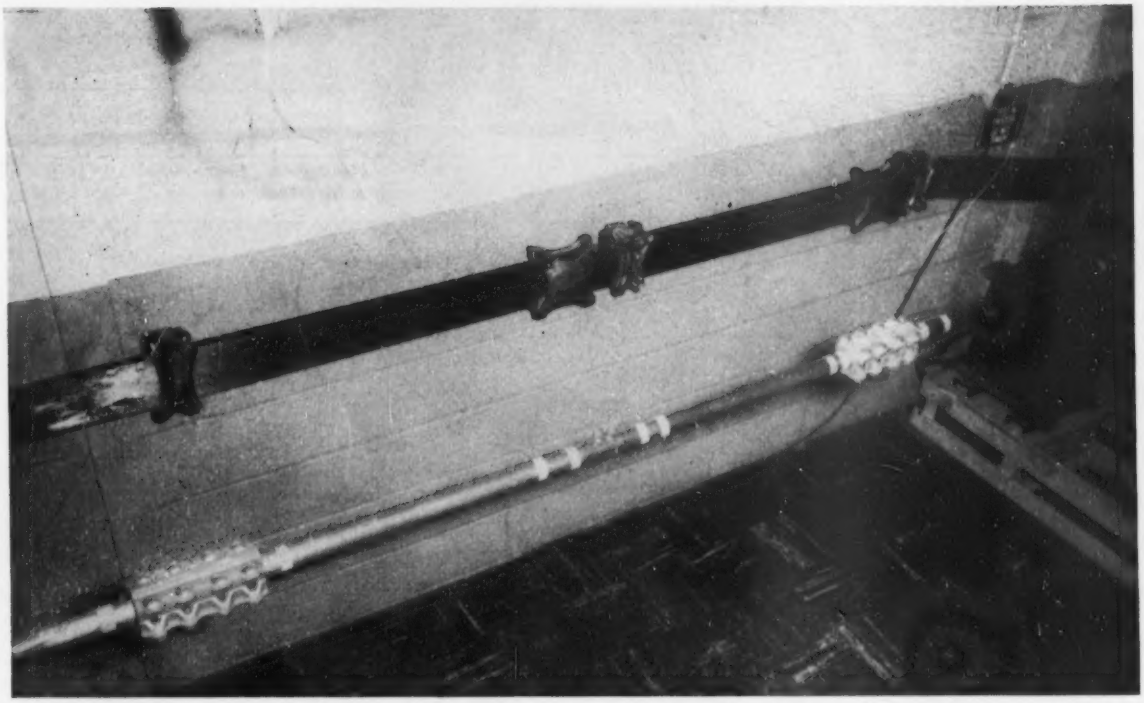
Assume Few Arrester Failures . . . It is basic BPA practice to use the minimum satisfactory BIL for respective voltage classes. These levels can be protected from anticipated lightning surges by assuming a small risk of arrester failure. At most BPA stations the number of lines on the bus inherently provides a protective level below that of arresters. At others, arrester ratings have been reduced to 75%, and in one station to 70%, to provide an adequate margin for reduced BIL's. In 2½ years of operation no failures of the reduced level arresters have occurred.

Transformers are now obtained with a nominal rating of 230 kv at the load ends of lines. The former 220-kv rating resulted in operating limitations when surge impedance loadings were greatly exceeded by use of reactive compensation at load end terminals.

Costs greatly favor autotransformers where the transformation ratio is favorable and a common grounded neutral acceptable. They serve well for 230/115-kv transformation or for supplying an intermediate voltage network on grounded neutral systems when the ratio of high to low voltage doesn't exceed 2. Use of single vs 3-phase units is limited by transportation facilities as well as the need for spare emergency equipment.

With an increase in BPA line loadings, 230/115-kv transformer ratings were greatly increased. Large banks are now composed of single-phase units, rated 150,000 kva self-cooled, and 200,000-250,000 kva with supplemental forced cooling. Relative size of 220-110-kv, 75,000/100,000-kva two-winding transformer banks with 1,050-500 BIL, and 230/115-kv, 150,000/250,000-kva autotransformer banks with 825-450 BIL is illustrated on the preceding page. Two rail-mounted 50,000/83,333-kva single-phase units serve as spares for all 230/115-kv, 150,000-kva autotransformer banks and the 230-115-kv, 75,000 and 150,000-kva two-winding banks.

Taps are a sizable cost item on autotransformers, particularly for levels above nominal. Nevertheless, they are needed to keep load voltages constant as well as to lend flexibility in shifting the unit to other locations. Customarily, BPA purchases transformers with tap-changing underload for ±5% of the nominal 230-kv rating. Tolerance above the tap rating is also necessary to maintain a good standard of service. If the system could be operated on a "flat" voltage concept, necessity for taps would be greatly reduced. Tap-changing under load is required to control reactive interchanges and voltages levels between the 230 and 115-kv systems.



HEAT CYCLE TEST set-up for aluminum connectors in series on 1¼-in. IPS copper tubing is shown. White bands hold thermocouple leads

Al Connector Requirements Set Up

Proper design and installation are considered vital factors for long life and trouble-free service when bi-metallic joints are involved. Corrosive atmosphere adds complications

I. MATTHYSSE, Asst Chief Engineer
H. P. DUPRE, Development Engineer
Burndy Engineering Co, Norwalk, Conn.

Proper design and installation of aluminum connectors which join aluminum and copper conductors are vital factors for long life and trouble-free service, particularly in corrosive atmospheres.

Such connectors should meet these requirements:

1. The aluminum body should be massive in comparison to the copper conductor to minimize electrolytic action.

2. The connector should be unbushed to avoid corrosion in between bushing and connector.

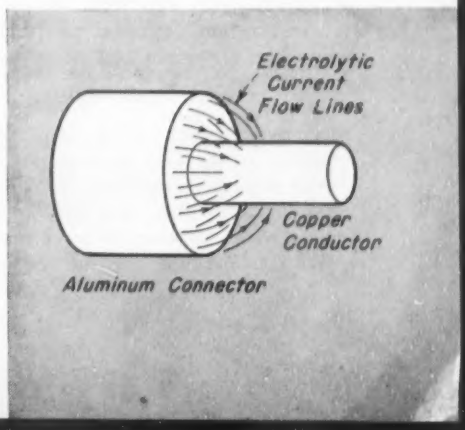
3. The design of the connector must protect the aluminum conductor from electrolytic attack. A bare aluminum connector in direct contact with the aluminum conductor and with wide separation between the aluminum and copper conductors provides this protection.

4. The contact grooves should enclose the conductors, to minimize the exposed conductor area. This aids in retaining the compound and resisting corrosion.

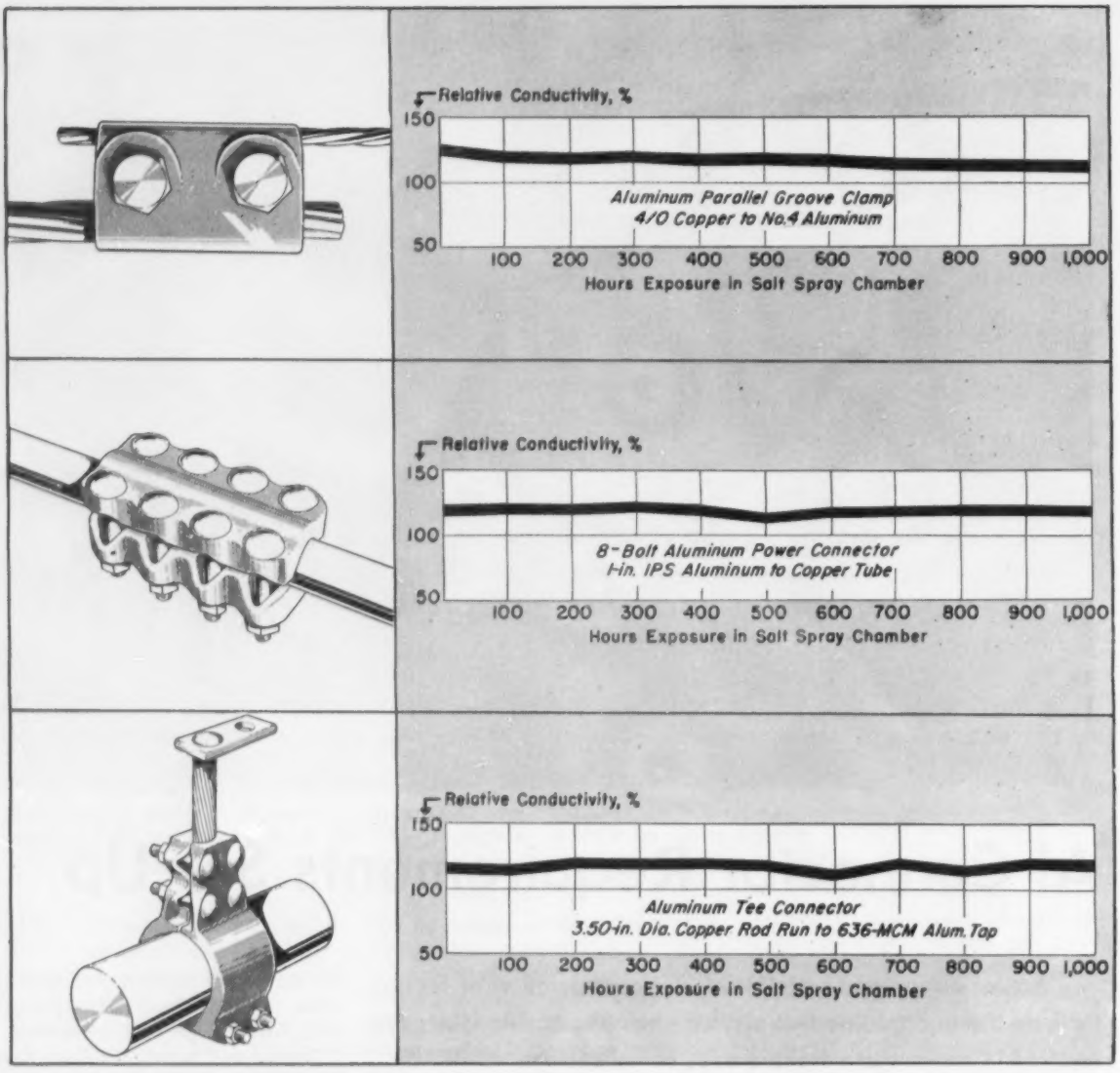
5. The connectors should have proper contact areas, should exert correct pressures, and use materials having the proper physical properties to allow for differences of expansion coefficients, creep, and relaxation.

Service and laboratory tests have proved that a correctly designed aluminum connector needs no bushings or liners in the groove that holds the copper conductor. As a matter of fact, aluminum connectors with soldered-in copper liners have behaved poorly in service and have deteriorated rapidly in the salt spray of the seacoast.

The design of a good aluminum-to-



ELECTROLYTIC CURRENT FLOW between aluminum connector and copper conductor is shown in picture at right. Current density decreases as connector size increases


Relative Conductivity, %
150
100
50
Aluminum Parallel Groove Clamp
4/0 Copper to No.4 Aluminum
100 200 300 400 500 600 700 800 900 1,000
Hours Exposure in Salt Spray Chamber
Relative Conductivity, %
150
100
50
8-Bolt Aluminum Power Connector
1-in. IPS Aluminum to Copper Tube
100 200 300 400 500 600 700 800 900 1,000
Hours Exposure in Salt Spray Chamber
Relative Conductivity, %
150
100
50
Aluminum Tee Connector
3.50-in. Dia. Copper Rod Run to 636-MCM Alum. Tap
100 200 300 400 500 600 700 800 900 1,000
Hours Exposure in Salt Spray Chamber

RESULTS of corrosion tests on illustrated aluminum connectors joining aluminum and copper show all joints had over 100% conductivity

copper connector must take into account the basic theory of electrolytic action. It is a well-known fact that electrolysis attacks only the anodic material, leaving the cathodic element unharmed. In an electrolyte, aluminum becomes the anode and copper the cathode with a potential difference of approximately two volts. Because of this situation, corrosion always involves the aluminum and never the copper.

Electrolytic Theory . . . A simplified drawing on the first page shows a copper conductor emerging from an aluminum connector. The flow lines indicate how the electrolytic current spreads out over the large surface of the aluminum, cutting current density.

Rate of corrosion is directly related to current density on the surface of the anodic material. Therefore, deterioration can be reduced to a minimum by making the exposed surface of the aluminum connector sufficiently large to keep electrolytic current densities at low values.

Even after long periods of service, the small loss of metal caused by corrosion on a well-designed aluminum connector is insignificant. This is true because the aluminum body is massive at points where corrosion occurs. Clamping bolts and areas of high stress which provide structural strength to the connector body are not exposed to corrosion in the design.

Conductor Protection . . . A good aluminum-to-copper clamp must resist corrosion itself, but equally important, it must protect the aluminum conductor from similar deterioration. Actually, this is the most vulnerable element in the joint.

Even a small amount of corrosion on an aluminum conductor can weaken it seriously. A small conductor experiences adverse mechanical effects much more rapidly than a large one. In some cases on the seacoast small aluminum conductors have deteriorated 50% in nine months.

Design of a good aluminum connector must incorporate provisions which guard against corrosion of the

aluminum conductor because of the presence of the copper conductor. First of all, the two dissimilar metals must have adequate separation. Even then, corrosion may occur if the position of the conductors is such that copper salts can wash over to the aluminum conductor. To prevent formation of an electrolyte between the two conductors, it is best to install the aluminum above the copper whenever possible.

Test Results . . . Clamps of the new design of various types and sizes were subjected to the severely corrosive atmosphere of the salt spray chamber. Fog of a 20% solution of sodium chloride was maintained at 98 F, and electrical conductivity of joints was measured after each 100 hours of exposure. Progress of corrosion was also visually noted.

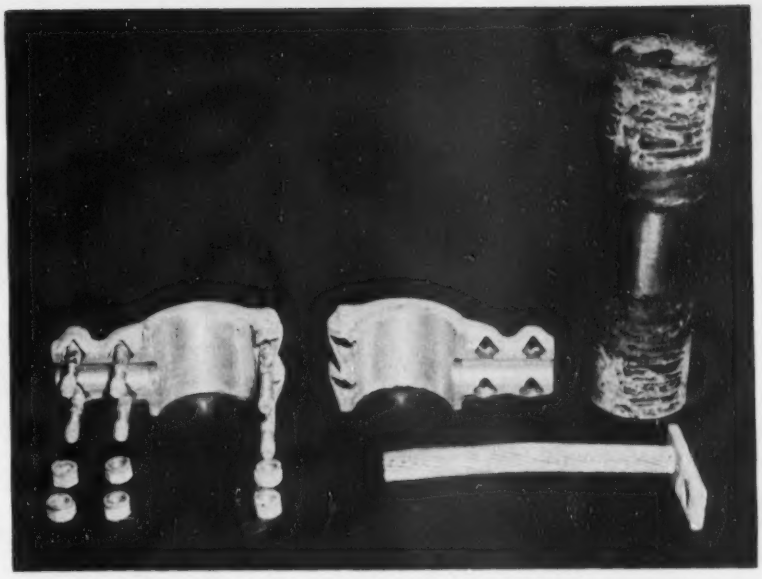
Typical aluminum connectors which were used in the test program together with corresponding graphs of joint conductivity are shown (p 106). All units shown were cast aluminum alloy with aluminum-alloy bolts and nuts. They were unplated, and no bushings were used in the grooves for the copper conductors. Penetrating connector compound was used on the contact surfaces.

The graphs show that all joints had well over 100% conductivity, relative to equivalent conductor lengths, at the start of the tests. Moreover, conductivity remained virtually constant during the entire 1000 hours that the connectors were in this severely corrosive environment.

Much shorter periods in such a salt fog chamber are usually considered indicative of a satisfactory connector life. For example, aluminum aircraft terminals must undergo only 100 hours of exposure in the salt-fog chamber in order to meet military specification MIL-T-7099B.

The three connectors illustrated cover widely different sizes and types applied to large and small conductors. One involves No. 4 stranded aluminum and 4/0 stranded copper. A second is a joint between 1-in. IPS aluminum and copper tubes. A third is a tee for 3½-in. diameter copper and 750 MCM aluminum.

Visual Inspection . . . Appearance of the connectors after salt-fog exposure is another method of evaluating corrosion effects. A picture shows the tee connector after the test, disassembled to display the bright, clean contact surfaces. Both conductor and connector surfaces were unattacked except for minor pitting on connector-end faces adjacent to the copper conductor. These excellent results were obtained even though the copper was directly over the aluminum conductor in the corrosion chamber, a situation more severe than recommended practice.



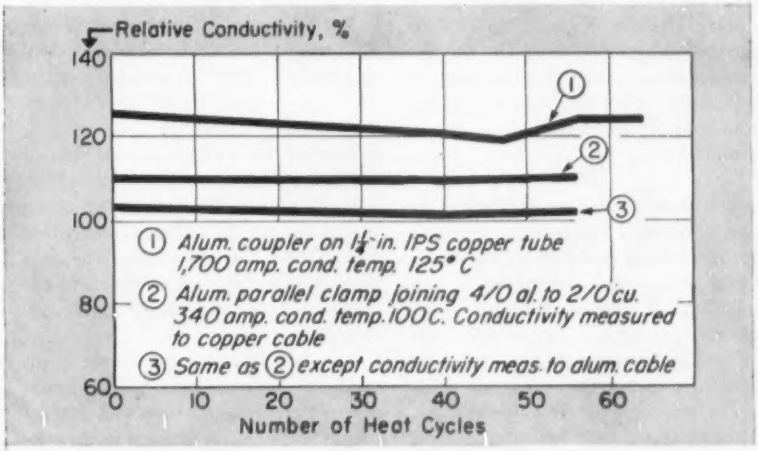
TEE CONNECTOR disassembled after corrosion tests shows bright, clean contact surfaces. Except for minor pitting on connector-end faces adjacent to copper, there was no corrosion

Many laboratory tests were made to verify why field experience with copper bushings has been unsatisfactory. A number of commercially available solders were employed together with several techniques, but all produced joints with poor corrosion resistance.

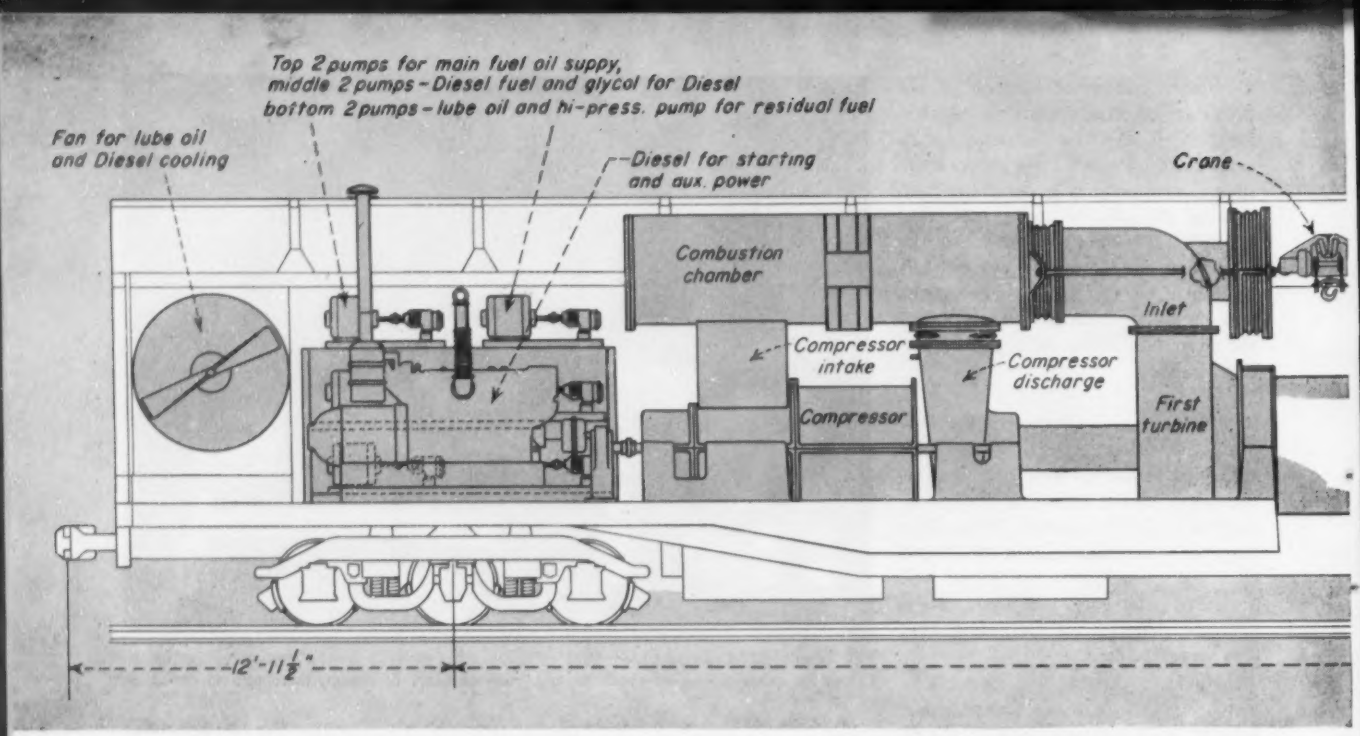
Standard practice requires the use of a connector compound in the grooves for an aluminum conductor, but it is rarely applied to grooves which are copper bushed. If compounds were applied to such installations, it is doubtful that they would be effective in preventing corrosion in between the bushing and the connector.

Heat Cycling . . . In addition to being able to withstand the corrosive effects of environment, a good connector must also be designed to carry the

(*Continued on page* 200)



EFFECT OF HEAT CYCLING on aluminum connectors when applied to joints between copper and aluminum conductors is brought out by charts. See story for details of various tests


Top 2 pumps for main fuel oil suppy,
middle 2 pumps - Diesel fuel and glycol for Diesel
bottom 2 pumps - lube oil and hi-press. pump for residual fuel
Fan for lube oil and Diesel cooling
Diesel for starting and aux. power
Crane
Combustion chamber
Inlet
Compressor intake
Compressor discharge
Compressor
First turbine
12'-11½"

Navy Puts 4,500-Kw Gas Turbine

M. A. MAYERS, Burns & Roe, Inc, New York, N. Y.

L. F. DEMING, Bureau of Yards and Docks, U. S. Navy, Washington, D. C.

F. O. HENNIG and **J. K. HUBBARD,** Clark Brothers, Olean, N. Y.

A mobile, gas-turbine-driven electric generating plant is being built by the Bureau of Yards and Docks, U. S. Navy. The 4,500-kw plant will be rugged enough to be attached to any railway train and hauled anywhere in the United States without special care. It can go into operation within 24 hours of its arrival. The car (shown above) is 85 ft 5 in long, 10 ft wide, and 14½ ft high.

The plant is designed to supply power in emergencies anywhere in the country. Utilities, especially those with widespread systems, may find similar plants useful. They cost little more than a stationary steam plant of the same capacity and have the advantage of mobility.

Attach It to Any Freight Train . . . Biggest problem involved in designing the car was to make it so shock resistant that it could be moved in any freight train without damage to the delicate generating equipment. All equipment mountings and supports are designed to withstand shock loadings of twice gravity in any direction.

But as shock loadings often exceed 2 g, special truck springing and car snubbing will be installed to control transverse and vertical accelerations to values below 2g, even at speeds up to 60 miles an hour. Longitudinal accelerations, however, could be limited to this value only by keeping switching speed at 5 mph or lower. So a special cushioned draft gear will be installed. This will provide a maximum draft gear travel of 13½ in. instead of the usual 5½.

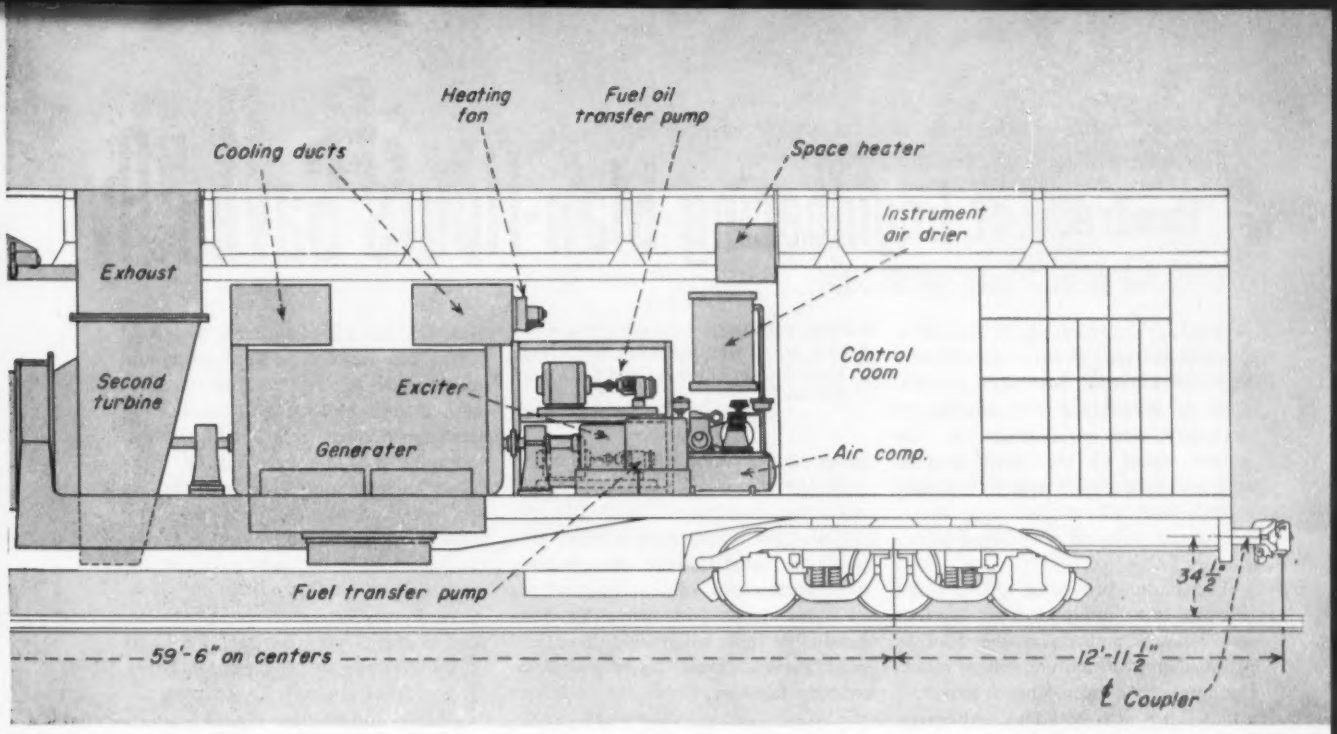
Further to assure the stability of the main units, they are mounted on independent sub-bases, each of which is stiff enough to assure alignment of one of the main unit shafts. The connection of these bases to the main car frame will further damp transit accelerations.

The gas turbine power unit is an open cycle machine having independent compressor-drive and power-output turbines. It is rated at an output of 4,500 kw at an altitude of 1,000 ft with an ambient temperature of 70 F. Turbine inlet temperature under these conditions is expected to be 1,350 F.

The power unit has a single axial flow compressor driven by a two-stage high-pressure turbine at 5,000 rpm at full load. Air flows from the compressor discharge to a single combustor of the contraflow design, which is mounted horizontally above the compressor. High-temperature gas from the combustor flows to the nozzles of the high-pressure turbine from which it is discharged through a flexible duct to the low-pressure or power turbine.

Power at 50 or 60 Cycles . . . The power turbine, which also has two stages, is directly connected to the generator through a flexible coupling. As it is independent of the compressor shaft, no gearing is needed to drive the alternator on either 50 or 60-cycle systems. On 60-cycle systems the power turbine runs at 3,600 rpm, on 50-cycle systems it runs at 3,000 rpm.

Any distillate fuel oil may be used. It is hoped that in the near future modifications will permit use of residual fuels. The fuel supply system



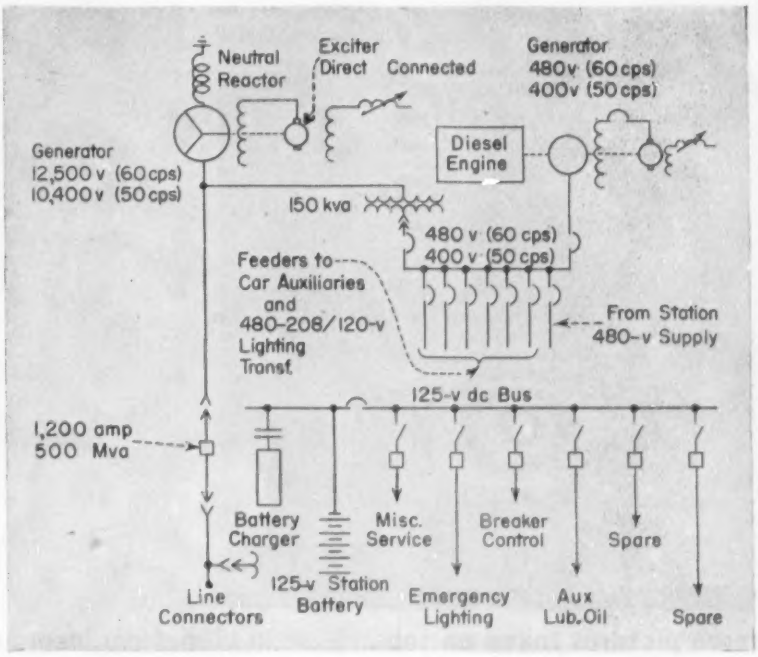
in Mobile Shock-Resistant, Plant

of the car, therefore, is designed for handling them. Provision is made for heating by the turbine exhaust to temperatures suitable for injection into the combustor. Of the three burners in the combustor any one can be shut off and withdrawn from the combustor without shutting down the plant. The burners have two concentric fuel sprays to assure good atomization over a range of fuel flows from 10 to 1.

How Speed Is Controlled . . . Constant speed-governing utilizes pneumatic control equipment having a pneumatic speed transmitter, driven from the power-turbine shaft, which sends a pressure signal proportional to rpm to the speed controller. Auxiliary devices in the system provide high temperature and anti-surge acceleration control. The speed controller has an adjustable droop characteristic; so it may load the turbine proportionally when operating the generator in parallel in any given system. Emergency overspeed trips are provided on each turbine shaft.

The main alternator is an air-cooled machine capable of delivering full turbine capacity at either 50 or 60 cycles. Design voltage at 60 cycles is 12,500 v while at 50 cycles it is 10,400 v. Sufficient flexibility in excitation is provided to permit matching any 60-cycle system voltage between 11,500 v and 13,800 v. At 50 cycles any voltage can be met between 9,500 v and 11,500 v.

(*Continued on page* 199)



Hundreds of Engineering Man-Hours Saved By

LOWIS BOWERS, Advertising Dept
Photos by **JOHN MASSEY,** Engineering Dept, Florida Power & Light Co, Miami, Florida

A visual reference file of full color, three-dimension pictures of Florida Power & Light Co substation installations is maintained for use by its engineers and draftsmen. It has proven easier to use, more graphic and complete than many full written reports, and is a real economy measure which pays off in more efficient work.

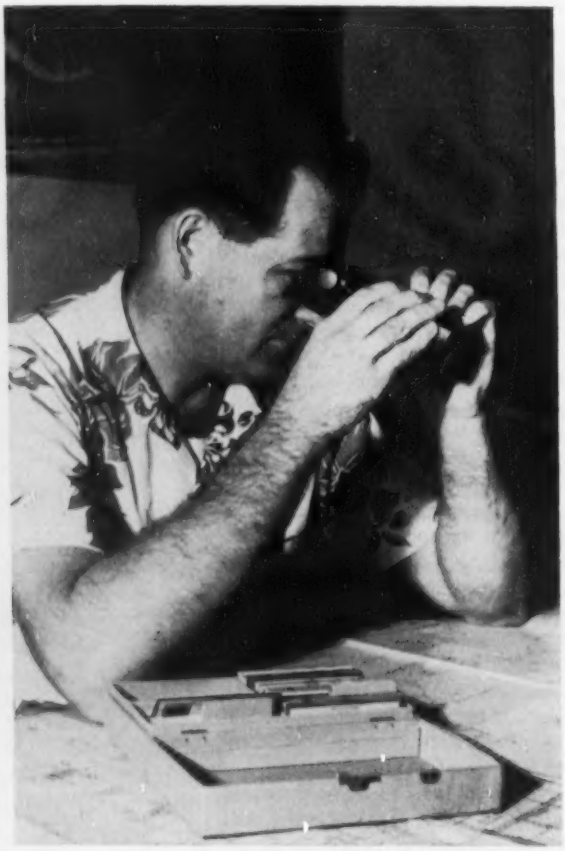
The file has proved of special value because the interconnected system stretches up and down the Florida peninsula, covering hundreds of miles. Capability has been upped two and a half times since V-J Day. Although much construction work has been done, there is still under way part of the 10-year, $332-million expansion program.

In the Miami offices engineers and draftsmen can consult the 3-D picture file and get as accurate a view of a plant or substation as though they were on the spot, sometimes hundreds of miles away. Obviously, this is an invaluable aid when additions and modifications must be planned to existing facilities.

Forerunner of Stereo . . . First used 10 years ago by a forward-looking young company engineer, E. M. Keeler, the 3-D equipment consisted of an old parlor-type stereoscope and homemade cards holding pictures pasted side by side and stapled together. Pictures were obtained painstakingly by photographing a scene once, then moving slightly to the left or right and photographing it again. However, results were quite good, and increasing use was made of the photographs.

A Stereo Realist camera, viewers, and portable-type files are now used in the Engineering Department. More than 20 draftsmen and engineers regularly consult the file. Many of the engineers now handle the camera like pros and take it with them on many field trips.

Stereo pictures taken on job . . .



aid engineers design layouts . . .

3-D Pix

File of 1,000, 3-dimension color slides taken by Florida Power & Light Co engineers on construction projects has saved thousands of dollars. More efficient work results from a better understanding of field conditions

Time-Saving Example . . . One such trip was recently made to the company's northern division to study the physical conditions confronting conversion of 176 miles of existing transmission lines and 10 substations from 69-kv to 115-kv operation. Several weeks of extensive work would have been required to take notes at each substation and transmission pulloff, and then some details might have been omitted.

So no notes were taken, but 14 rolls of film were used to photograph the facilities from every possible angle. The entire time required to take 280 photographs and visit the substations involved was three days. Thus, on this single job, an estimated four weeks' time was saved. Multiply this by scores of trips each year, and it is easy to see the substantial savings effected in time and work.

Field Conditions . . . More efficient work results too from a better understanding of field conditions. The engineer took back to draftsmen in the Miami office exact details of every scene as viewed by the engineer himself and recorded by the all-seeing eye of the camera. This made it easier to describe the nature of the work. And, speaking on the telephone, personnel in Miami could understand and discuss intelligently construction details with the supervisor on the job hundreds of miles away.

When young draftsmen are puzzled over details of a new installation, the files are frequently used to show them a similar installation already completed and in use.

Used At Steam Plant . . . In addition to the camera used by the Engineering Department, another is used at the Cutler Plant at Miami. Photographs are made of the inside of boilers and other equipment when the units are down for overhaul and before any maintenance work is done. After completion of the work, photographs are again taken.

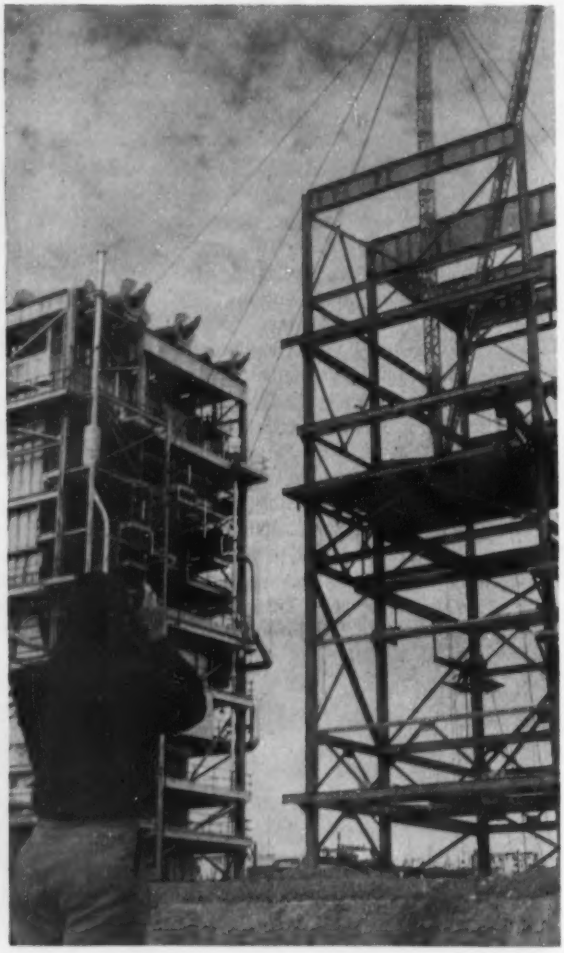
The pictures show clearly points of wear and can frequently be used to anticipate the amount of work and

and help staff check drawings against field installations

Checking Details on Job Minimized by 3-D

OLD METHOD of notetaking and sketching before planning substation extension has been dispensed with since Stereo camera proved better

IMPROVEMENT over old method (above) was home-made stereoscopic slides from black and white pix taken by engineer with box camera



NOT A PLANE SPOTTER but just an engineer of Florida Power & Light using 3-D camera to take progress shots of plant construction

time required for the overhaul job. Also, costly trouble may even be anticipated before it develops. One such incident could save the company thousands of dollars and time by keeping equipment in service.

Cost of Equipment . . . At present, the company has three stereoscopic cameras valued at about $160 each, six viewers costing about $20 each, and 1,000 stereoscopic slides in full color. The modest investment has already paid for itself many times over in savings of time and money and in more efficient work produced.

Color film, 20 exposures on each roll, costs less than $5 a roll and in emergencies can be purchased at the corner drug store. The film is sent to the manufacturer for processing, and color transparencies are returned mounted side by side ready for viewing. These are labeled with the date, description, and location of the property and are filed according to location.

Engineering Man-Hours Saved . . . "Using the file saves hundreds of man-hours each year," pointed out Harry Street, chief engineer. "It speeds up work that is done in the field; eliminates lengthy notes; and because it provides a really complete record of installations, the 'as-built' photographs make many subsequent field trips unnecessary.

"However, pertinent information should be placed on each picture, showing the time, place, and angle from which the picture was taken. Also, it is highly important that the photographic files be kept up to date."

Future Use . . . Even more extensive use of the photographs is planned. Engineers are taking the cameras with them on all their field trips, thereby building a record of existing facilities which is beneficial now and will be even more valuable in the years to come.

Future plans call for use of the stereoscopic camera in sales promotion and public relations work. Suitable pictures may even be projected onto a screen and used when training linemen and engineers.

ENGINEERING MEETING

What Heavy Residential User Needs . . .

. . . discussed at an all-day symposium conducted by the System Planning Committee of Pennsylvania Electric Association

Electric service needs of large-use residential customers are playing an increasingly significant role in distribution system design today and will play an even bigger role in the next decade. Whether this is a threat or a promise to utility revenue depends on whether rates are kept in line with the high cost of serving the large user. Today, at least, this load can be supplied adequately and at minimum cost without recourse to widespread use of 3-phase service but may require a higher service voltage.

These were the conclusions of an all-day symposium on needs of the large-use residential customer, conducted by the System Planning Committee of the Pennsylvania Electric Association at the Sheraton Hotel, Pittsburgh, on Feb. 8.

Predictions that residential use of electricity will reach 229 billion kwhr a year by 1963, bringing an increase in revenue from $2.65 billion today to $5.6 billion in ten years, were made by Westinghouse Electric Corp market planner, W. W. Morris. By 1963 residential use, he said, will be 36% of all energy sold, compared with 25.2% today. And, Morris predicted, energy used by comfort and entertainment appliances such as TV and air conditioning will approach that of lighting. He foresaw strong gains in appliances requiring 240 v. While overall use of energy will double, the average use of the 240-v appliance will jump 136% against an increase of 78% for the remainder, Morris declared.

Rates a Problem

A warning was issued by Pennsylvania Power Co's Vice Pres P. G. Dingledy that today's rates are not in keeping with the cost of serving the large-use residential customer. If such customers are to be served profitably and equitably, Dingledy said, some charge must be made based on the demand or capacity required to serve them. Such a rate should also include a provision to reward the customer for improved load factor and promote more complete use of facilities, he added. Since the end of World War II, he said, utilities have invested $300 in added facilities to serve each new kilowatt of diversified demand. If capacity is to be added at this cost, he said, new load must furnish adequate compensation. The bottom step of most residential rates was never designed for the high demands being added under capital costs prevailing in the industry today, Dingledy noted.

Load Factors Falling

Residential load is moving in the direction of lower annual load factors under the influence of air conditioning and house heating, Chase Hutchinson and W. R. Bullard, Ebasco Services, warned. They, too, urged utilities to provide customer incentives for improved load factor. Among the recommendations for handling air conditioning and other heavy residential loads advanced by Hutchinson and Bullard were these:

1. Three and 5-hp residential motors should be single phase. Three-phase service should be restricted to customers with large motors—7½ hp and up.

2. Distribution at 240-480 v offers savings to utilities and can be attractive to customers under today's conditions.

3. A secondary system using 2/0 aluminum is both economical and satisfactory for either 120/240 v or 240/480 system. Transformer size and spacing are the crucial items.

4. While 4-kv distribution can serve large residential loads, higher voltage will promote economy, appearance, and reliability and simplify structures.

5. Voltages in the range of 11 to 25 kv permit widely spaced, large substations, connected to high voltage transmission lines with resultant economy and reliability.

Either 3-phase or single-phase can supply the large-use residential customer satisfactorily, but 3-phase service will cost the utility 1½ times as much, according to H. G. Barnett, Westinghouse. It may cost the customer more for motors, controls, and wiring, however. Barnett left no doubt that 240/480 v is the cheapest way to distribute power in any area. But he said that 120 v will be needed for some time and provision for it on the customer's premises in addition to 480 v may be unfavorable economically.

The high cost of 3-phase service to residential air conditioning was also stressed by H. E. Campbell, General Electric Co. Not only does it cost $325 to $600 more, but the starting voltage drop for a 3-phase, 5-hp motor is only 0.6% less than a single-phase motor at the end of a 100 ft secondary, he said. Moreover, single-phase motors are free from the unbalanced voltages to which 3-phase units are subject. Phase converters aren't much help either, Campbell declared, since their use derates a 5-hp motor to 3 hp.

Single-Phase Adequate

Further evidence in favor of supplying residential motors up to 7½ hp, single-phase was provided by R. D. Brown, chief engineer of Monongahela Power Co. The added cost of 3-phase supply when passed on to the customer may well offset the savings he gained by purchasing 3-phase equipment. Single-phase air-conditioning equipment supplied over a conventional 3-wire, 115/230-v system will give satisfactory operating results to both customer and utility. Brown, too, noted that 3-phase motors complicated the problem of maintaining balanced voltages.

BEFORE AND AFTER VIEWS of Sunset Avenue, Asheboro, N. C., show success of street widening and paving. Project encouraged merchants to put in new store fronts and modernize

'Finer Carolina' Awards Made

Asheboro and Grifton, N. C., and Latta, S. C., are "Carolina's Finest." They won the title in the "Finer Carolina" competition conducted by Carolina Power & Light Co.

The three towns won $1,000 first prizes in their respective population classes. The $500 second prizes went to Manning, S. C., Burgaw and Maysville, N. C. Third prizes of $250 went to Dunn and Wallace, N. C., and Lamar, S. C.

Fifteen towns were cited for honorable mention and $100 each.

Grifton became the only repeater as a first-place winner by investing last year's winnings in a new city park. Latta was a second-place winner in the 1952 contest.

Asheboro, winner among the larger towns, won its award for these accomplishments: general improvement and beautification, new industry, adding school facilities, improving and extending recreational facilities, and cultural development. Gains noted for the year included the new $3.5-million hosiery finishing plant of Burlington Mills.

Latta, winner among middle-sized towns, listed these projects: marking streets and numbering houses, beautifying the health center, beautifying pool and playground, expanding community library, landscaping boulevard, and paving sidewalks.

Grifton improved recreational facilities, built a park, organized activities for teen-agers, opened 9,150 ft of streets and paved 3,364 ft, extended sewer and water systems, expanded housing, improved and expanded business facilities, and approved a $100,000 bond issue for schools.

Scholarships Offered Children of Customers

A program which will provide five $500 scholarships each year for sons and daughters of its customers has been announced by Pennsylvania Power & Light Co. The first awards will be made this year for the college term beginning in September. A sixth scholarship for children of employees has also been established. All recipients will be required to show financial need.

The scholarships will allow the recipients, whether boys or girls, to study at any of the 16 colleges located in the company's service area. Any course leading to a baccalaureate degree is acceptable. The recipient has no obligation to work for the company upon graduation. The company has no obligation to employ him.

Realizing that tuition does not pay the full cost of educating a student, the company will pay $500 a year to the college for each winner admitted.

The awards will be reviewed at the end of each semester and will be renewed if grades and personal conduct have been satisfactory.

When the program is in full progress, the company will be supporting 24 scholarships at the cost of $12,000 a year.

Awards will be made by a committee of educators and one representative of the company, none of whom will have any connection with the schools at which recipients may study.

WASHINGTON COMMENT

JESSE MOCK

The Eisenhower Administration has answered critics of the power policy it has been developing.

For the time being, the sharp and thoughtful reply remains little publicized in the files of a Senate judiciary subcommittee. But in the months ahead its importance is sure to be recognized by the men who defend or oppose the power policy of the Eisenhower Administration.

GOP answers critics of its power policy

Written by Clarence A. Davis, Interior Department solicitor, the reply is a careful analysis of opposition arguments. It defends the legal and philosophical basis of the policy adopted by the federal government for the development and marketing of electric power.

As Davis views the situation, the opposition case is based mainly on these charges:

- The government is failing to provide for the full power requirements of preference customers.
- Administration of the preference clause is not being carried out in an aggressive manner.
- Rates for federally produced power are sure to increase.

Answers and commentary on these charges take up more than 14 single-spaced typewritten pages. There is a general discussion of the legislative background of each of the charges as well as an explanation of the Republican policy now in operation.

The Interior statement freely admits that the federal government does not intend to assume a utility responsibility for supplying power to preference customers. Even if there was a philosophical leaning in this direction, says Davis, laws now on the books would prevent it. Tennessee Valley Authority is an exception to this general argument, which applies only to power either developed or marketed by Interior Department agencies.

From a strictly legal standpoint, Davis has some doubts as to whether Interior agencies are empowered to either purchase or exchange steam generated power to back up the output of federal hydroelectric plants.

"The whole question of the right to purchase steam power by the department is shrouded in legal uncertainty," he asserts. But, he continues, "we can state positively . . . that there is no authority in the Assistant Secretary to make contracts for the direct purchase of steam energy in the Missouri Basin, and certainly no authorization to go into the brokerage business for the purchase of steam power for resale to these cooperatives."

Will Buy Steam Power . . . But whether it has full authority or not, he said, Interior does intend to acquire, either by purchase or exchange, enough steam power to maintain a firm output of the federal Missouri Basin projects in an average water year.

In the section on the preference clause, Davis points out that the statutory directive to give public bodies and rural co-ops preference in purchase of federal power might very well run into conflict with other provisions of the various marketing directives. For instance, he notes Interior is also charged by Congress to market federal power in such a manner as to encourage its most widespread use.

Now suppose a preference customer takes all the power from a certain federal project. Suppose a large block of this power is sold to a single industry consumer. In such a case, Interior might be fulfilling the requirements of the preference provisions, but it would not necessarily be encouraging the most widespread use of the power.

On the matter of increasing rates, the Davis statement concedes that power rates for many projects are likely to rise. But this is a "pure matter of arithmetic" and does not involve any policy, the statement says.

Fact is that rates on a number of federal projects are based on estimated project costs. Inflation during the last eight years has brought the actual costs to twice the original estimates, and rates will have to be adjusted to reflect the situation, Davis feels.

Summing up the attitude of Republican Interior officials, Davis commented: "The less government there is in Washington and the more control there is in the areas served, the better in the long run the areas will be."

TECHNICAL NOTES

ARCHER E. KNOWLTON

Capacitor tests in the field can be justified on four grounds: (1) rated var output at rated voltage and frequency, (2) adequacy of dielectric, (3) discharge-time of internal shunt resistor and (4) magnitude of radio-influence voltage.

Conductivity of moist skin is likely to be 100 times as high as that of dry skin.

Shutdowns of one large new plant in its first 27 months totalled 49 and of these 3 were tripouts and 11 of an emergency nature; 35 were scheduled.

Torque at high slips is much less for a 3600 rpm induction motor (such as used for boiler feed pump drive) than for motors designed for lower synchronous speeds.

Each unwarranted addition to an assembly of control devices introduces a new potential source of false operation, test error, failure or risk of double grounds on the circuitry.

Bus regulation fits where (1) substation is located near load, (2) feeders approximately equal in length, (3) feeder and phase loads balanced, (4) load cycles coincidental.

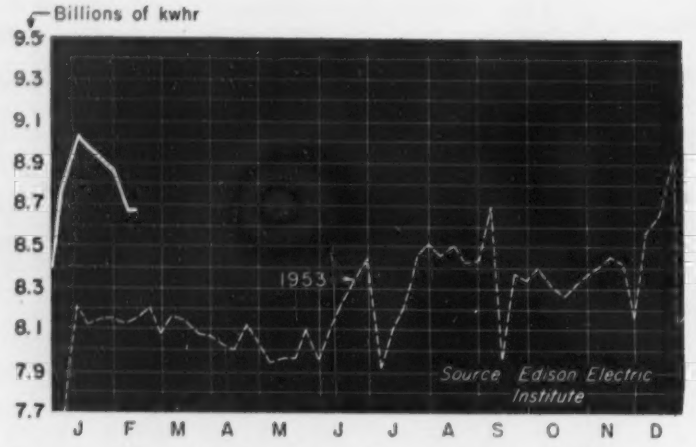
Single liquid solution embracing the fissionable fuel, the moderator and the coolant was used in the Oak Ridge reactor when it developed 150 kw.

Lodge-pole pine appears to be appropriate timber for spar crossarms. There is absence of undesirable knots, bearing strength under compressive loads is favorable. Creosote penetration is not, however, as deep as with southern yellow pine.

Ratio between fault and load current in the case of phase-comparison relaying is a limiting factor in application to lines of more than two terminals. Directional-comparison carrier escapes this limitation.

Overloads are unlikely for power plant auxiliary motors under normal operating conditions. Abnormal conditions are indicated by increase above normal operating current.

STATISTICS



Output Week Ended Feb. 13—8,684,000,000 Kwhr

Seasonally Adjusted Index†—160.2

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 13	+6.6	+5.9	+2.8	−1.2	+7.3	+19.3	+6.6	+6.2	+13.2	+5.4
Feb. 6	+6.7	+4.7	+3.0	−0.4	+7.0	+19.3	+8.7	+5.3	+13.8	+3.5
Jan. 30	+8.6	+5.9	+3.5	+1.5	+11.5	+18.7	+10.7	+9.3	+21.6	+8.3

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Dec.	81.2	78.1	75.5
Capacity (Million Kw)	Dec.	91.49	89.81	82.23
Production (Billion Kwhr)	Dec.	39.06	36.38	36.45
Hydro	Dec.	8.67	6.91	8.22
Fuel	Dec.	30.39	29.47	28.23
Fuel Consumption				
Coal (Million Tons)	Dec.	10.87	10.17	10.75
Oil (Million Barrels)	Dec.	7.62	6.91	8.60
Gas (Billion Cu Ft)	Dec.	70.78	81.13	59.81
Sales (Billion Kwhr)	Nov.	31.59	32.21	30.08
Residential	Nov.	9.02	8.70	8.16
Commercial	Nov.	5.50	5.62	5.01
Industrial	Nov.	14.95	15.56	14.91
Other	Nov.	2.12	2.33	2.01
Net Income Class A & B Companies ($ Million)	Nov.	84.99*	76.19	80.63
Estimated Dec. '54 Peak (Million Kw)	Nov.	94.7	94.8	96.1
Kwhr per Residential Customer (12 Month Average)	Nov.	2,331	2,318	2,155
Revenue per Kwhr Residential Service (12 Month Average)	Nov.	2.75¢	2.75¢	2.77¢
Canadian Production (Billion Kwhr)	Nov.	5.45	5.51	5.22

Business Statistics

FRB Industrial Production Index†	Dec.	125*	130	131
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	369.0	372.4	345.3
EW 4 Industry Production Index†	Dec.	120.4	121.8	125.9
ENR Construction Cost Index††	Jan.	128.7	128.2	123.1
BLS Consumer's Price Index	Dec.	114.9	115.0	114.1
NEMA Insulation Materials Sales Index†	Nov.	130	154	155
NEMA Electric Appliance Sales Index†	Nov.	70	91	100
NEMA Household Refrig. Sales Index†	Nov.	35	46	77
Metal Prices Feb. 16				
Copper, Conn. V., lb		$.29½-.30	.29½-.30	.24¼
Lead, N. Y., lb		.13	.13¼	.13½
Zinc, prime Western E. St. Louis, lb		.09¼	.10¼	.11½
Tin, Straits, qual. N. Y. lb		.85	.85	1.21½
Aluminum, ingot, base price		.21½	.21½	.20½
Nickel, base price		.60	.60	.60
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1, heavy, Pitts., ton		29.00	30.00	45.00

* Preliminary ** Revised † 1947-49=100 †† 1949=100

Figures of the Year: Some Finals by FPC

Just for the record, here are some official industry figures of the year from the Federal Power Commission, originally estimated for the statistical issue, (EW Jan. 25) by Edison Electric Institute.

Yearend Capacity . . . As of December 31, the utilities could count on 91,490,684 kw of capacity. (EEI's estimate—90.9 million kw). This is an increase of 9,265 thousand kw over 1952, percentage-wise an 11.3% gain.

December Peak . . . The all industry peak in December was 81.2 million kw, a 7.6% increase over the 75.45 million kw for December 1952. Capacity stands at 12.7% above that peak.

Generation . . . Last year total utility generation came to 442,284,827,000 kwhr. (EEI estimate was 442,014 million kwhr). Hydro plants produced 105,049,367,000 kwhr, or 23.8% of the total—about the same amount they produced last year.

Industrial generation totalled 71,233,046,000 kwhr, bringing production to a grand total of 513,517,873,000 kwhr for the year. Generation during December for the utilities alone was 39,062,236,000 kwhr.

Business Inventories $79.8 Billion in December

Business inventories having been slipping a bit—a fact well-forecasted, and certainly a necessary event. On a seasonally adjusted basis, total inventories had a book value of $81 billion at the end of December, $200 million below November. Manufacturers' and wholesalers' stocks each dropped about $200 million, while retailers' stocks increased by that amount.

Still, the December unadjusted total of $79.8 billion was $3.8 billion above the end 1952 figure. A breakdown of that gain shows about a $2.5 billion increase in manufacturers' stocks, a $1 billion increase in retail, and about a $400 million increase in wholesale inventories. When translated in terms of sales, end 1953 inventories were equivalent to 1.7 months of sales, as compared to 1.6 months at the beginning of the year.

FINANCIAL

TVA, Air Force Negotiate Deal

Authority to supply all power needs of Arnold Engineering Development Center at maximum cost of 2.75 mills per kwhr

Arnold Engineering Development Center will pay the Tennessee Valley Authority a minimum of 2.45 mills and a maximum of 2.75 mills per kwhr for its electricity, Brig Gen S. R. Harris, Jr, AEDC commanding officer, recently announced.

AEDC, located at Tullahoma, Tenn., also will pay TVA certain fixed charges, such as line rental, and demand charges on power required for operation of the center, Harris said.

Contract Expires in 1957 . . . The scale and charges are set out in a contract negotiated by the Air Force and the TVA. The contract is retroactive to Oct. 12, 1952, and will expire Dec. 31, 1957. TVA will provide all electric power required by the AEDC with the exception of portable emergency generating equipment.

The contract, on which an agreement was reached after four years of negotiations, was signed by James Oliver, TVA general manager, and James H. Douglas, under secretary of the Air Force.

AEDC officials said a new determination of the annual power consumption of the air center is being made. An estimate of the AEDC's annual power bill under the contract was not available pending the new figure.

The AEDC rate was based on the use of "off peak" power for operation of the huge testing facilities. A large amount of power will be required so that the principal operations at AEDC are to be scheduled during the night hours when the drain elsewhere on the TVA system will be at a low peak.

Maximum Demand To Be 318,000 Kw . . . Gen Harris has estimated that the maximum power demand will be 318,000 kw, which is reported to be more than the peak demand of the greater Nashville area, including that city's industrial consumption.

Negotiations on the AEDC power contract were started in 1950 by the Tullahoma District, Corps of Engineers. At that time it was reported that TVA had proposed a flat rate of 7.2 mills per kwhr, and that the engineers felt the rate should not exceed five mills per kwhr.

The difference at that time amounted to about $500,000 annually, in the AEDC power bill, based on a yearly consumption of about 275 million kwhrs. Total power requirements of the AEDC facilities have been increased considerably since then.

After the Corps of Engineers and TVA were unable to reach an agreement the power rate issue was transferred to Washington late in 1950 and was taken up by top defense department and TVA officials.

Pending settlement of the power rate question, TVA agreed in 1950 to provide construction power to the AEDC project at a rate ranging from 7.5 mills to 15 mills per kwhr.

FINANCIAL BRIEFS

Detroit Edison Co is planning to refund $40 million Series M 3⅞% bonds due 1988. These bonds are redeemable at a 5.43% premium until April 30 and at a 5.28% premium during the next 12 months . . . **Connecticut Public Utilities Commission** will begin hearings on Feb. 23 on the Connecticut Power Co's application to increase residential rates by $1.5 million a year . . . **Metropolitan Edison Co** has voluntarily postponed to May 15 a proposed rate revision that would increase bills of its residential customers and reduce charges to industrial and commercial users. The company said it needed the extra time to prepare additional rate information requested by the Pennsylvania Public Utilities Commission.

Georgia Public Service Commission has postponed until Mar. 2 hearings on its order for lower rates for Georgia Power & Light Co and possibility of merging that company with Georgia Power Co (EW, Jan. 4, p 7) . . . **Cleveland Electric Illuminating Co** has asked Ohio Public Utilities Commission to increase rates generally by $5.3 million annually.

Minnesota Power & Light Co will pay on Mar. 1 a quarterly common stock dividend of 30¢ a share as compared with 27½¢ plus an extra of 10¢ in December, following a two-for-one stock split . . . **Southwestern Public Service Co** has sold privately $12 million first mortgage 3.65% bonds due 1984 through Dillon Read & Co . . . **Portland General Electric Co** will pay on April 15 a quarterly common stock dividend of 50¢ a share as compared with 45¢ previously. Company's stockholders will vote on a proposal calling for a two-for-one split of the common stock at the annual meeting to be held in Portland, Ore., on April 14.

For Volume 10 of the "Federal Power Commission Reports," which contains opinions and decisions for 1951, write Publications Division, FPC, Washington 25, D. C. Ask for order number FPC-A-45; price $4.75.

Norton-Decatur Cooperative Electric Co, Inc, has been given Kansas Corporation Commission approval to raise rates $46,000 annually.

Eastern Utilities Association is planning to sell $7 million collateral trust 4⅜% bonds due 1978 to institutions at 100% . . . On a regular 30-day filing with the New York State Public Service Commission, Consolidated Edison Co of New York has offered, effective Feb. 16, a 265/460 volt service when the rate schedule is agreeable to the customer and the company.

U. S. Power Policy Seen as Threat to NW Rates

Increases of as much as 35 to 40% in wholesale electric rates, amounting to as much as $15 million annually, could result from proposed changes in federal power policy, Dan Jolly, president of the Washington PUD Association, charged recently in Seattle.

The preliminary cost allocation at

McNary Dam would add $3 million a year to power rates while elimination of the interest component at Grand Coulee Dam in effect increases irrigation subsidies from power revenues, said Jolly.

"If successful, this Eastern-inspired attack would seriously curtail our industrial expansion and materially aggravate unemployment," charged the PUD official.

Puget Sound to Recover Annexed City Light Lines

The Puget Sound Power & Light Co will get back a small portion of its distribution system which it sold to City Light of Seattle several years ago.

City Light bought everything in the "Seattle competitive area," which extended to what then was the city limits of Renton, a small town not far south of the Seattle city limits. Renton since has extended its corporate limits, by annexation, to include a part of this competitive area.

Since Puget Power has a franchise to serve everything within the Renton city limits, City Light is preparing to sell it the facilities in the newly-annexed area. The price tag: $11,092.

Washington PSC Affirms WWP's Rate Increase

A temporary rate increase granted the Washington Water Power Co on Jan. 23, 1953, was made permanent early this month by the Washington State Public Service Commission.

After hearings in Spokane at which only token protests of the continued rate were presented, the PSC granted WWP the permanent rate amounting to 5.92% return on its investment.

The commission found the fair value of WWP property during the 12-month period ended Sept. 30, 1953, was $70,186,373. Gross revenue during a test period beginning Jan. 23 and ending Sept. 30 last year was $13,844,377 and total expenses $9,692,674.

The PSC ruled that the net operating income of $4,151,703 was a 5.92% rate of return on its investment. Although the rate was slightly higher than the 5.85% previously established by the PSC as reasonable

(*Continued on page* 198)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE 1954									
Feb. 11	**2.86**	**2.92**	**3.18**	**3.97**	**4.11**	**4.47**	**4.86**	**5.31**	**5.38**
Feb. 4	2.94	2.99	3.21	4.02	4.12	4.50	4.89	5.33	5.36
END OF QTR.									
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.32	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50

Data: Reis & Chandler, Inc.

EARNINGS

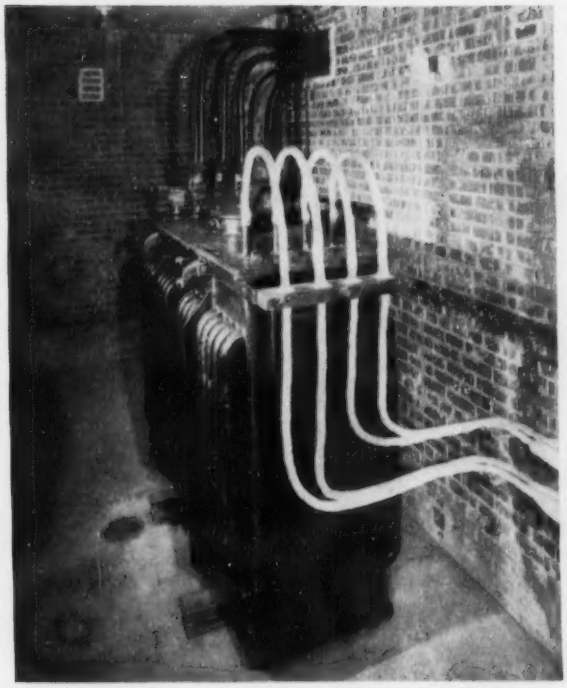
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Florida Power & Light	12	Dec.*	$8,392,185	$7,621,653	$3.07	$2.84
Hartford Electric Light	12	Dec.*	3,435,223	2,681,542	3.70(a)	2.81(a)
Pacific Gas & Electric	12	Dec.*	59,693,000	47,000,000	3.12(b)	2.52(b)

Notes—* Subject to year-end audit; (a) Based on 844,000 shares in 1953 and 1952; and (b) Based on an average of 14,114,427 shares in 1953 and 12,492,070 shares in 1952.

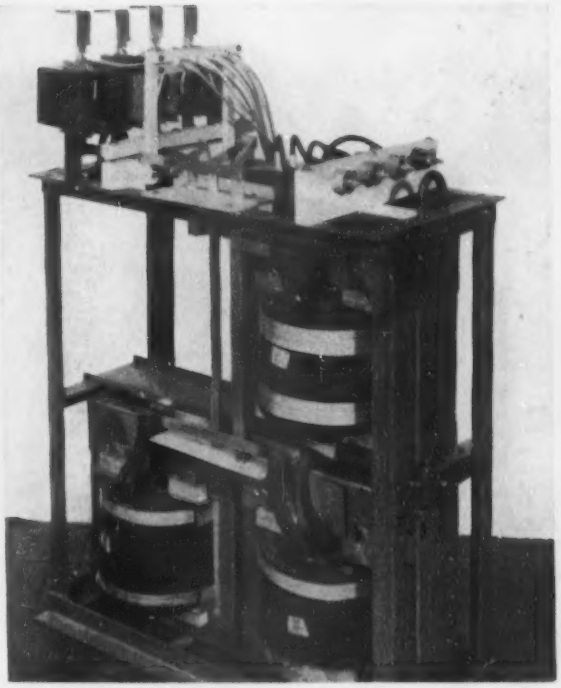
FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF FEBRUARY 11—17			
Bonds			
Pacific Gas & Electric—1st mtg 3⅛% due 1984	$60,000	101.09%	3.07%
Essex County Electric—1st mtg 3¼% due 1984	5,000	100.959	3.20
Common Stock			
South Carolina Electric & Gas—286,436 sh (being offered commonholders on a 1-for-10 basis, record Feb. 17 to expire Mar. 3; with subscription privilege including a subscription privilege for holders of less than 10 shares)	$4,225	$14.75	5.42%
SCHEDULE FOR FEBRUARY—MARCH—APRIL—MAY			
Bonds			**Bid Date**
Atlantic City Electric—1st mtg due 1984	$5,000	.....	Feb. 24
Houston Lighting & Power—1st mtg due 1989	30,000	.....	Mar. 1
Tacoma, Wash.—light and power revenues due 1964-79	5,000	.....	Mar. 1
Omaha Public Power District—electric revenues due 1956-84	12,000	.....	Mar. 2
Suburban Electric—1st mtg due 1984	4,000	.....	Mar. 3
California Oregon Power—1st mtg due 1984	10,000	.....	Mar. 9
Alabama Power—1st mtg due 1984	17,000	.....	Mar. 16
El Paso Electric—1st mtg due 1984	5,000	.....	Mar. 16
Pennsylvania Electric—1st mtg	12,000	.....	Mar. 23
Pacific Power & Light—1st mtg due 1984	8,000	.....	Mar. 29
San Diego Gas & Electric—1st mtg due 1984	17,000	.....	Mar. 30
Georgia Power—1st mtg due 1984	11,000	.....	April 6
Southern Indiana Gas & Electric—1st mtg due 1984	8,000	.....	April 13
Ohio Power—1st mtg	20,000	.....	April 14
West Penn Power—1st mtg due 1984	12,000	.....	April 20
Utah Power & Light—1st mtg due 1984	15,000	.....	May 19
Preferred Stock			
Long Island Lighting—70,000 sh $100 par	$7,000	.....	Mar. 3(a)
El Paso Electric—15,000 sh	1,500	.....	Mar. 17
Louisiana Power & Light—70,000 sh $100 par	7,000	.....	Mar. 23
Dallas Power & Light—70,000 sh $100 par	7,000	.....	Mar. 24
Northern States Power (Minn.)—150,000 sh $100 par	15,000	.....	April 14
Ohio Power—50,000 sh $100 par	5,000	.....	April 14
Arkansas Power & Light—70,000 sh $100 par	7,000	.....	April 27
Rochester Gas & Electric—50,000 sh $100 par	5,000	.....	.....
New York State Electric & Gas—50,000 sh	5,000	.....	.....
Common Stock			
Atlantic City Electric—151,672 sh	$.....	.....	Feb. 19(b)
El Paso Electric—76,399 sh (to be offered commonholders on 1-for-10 basis, record Feb. 23 to expire Mar. 11)	.....	.....	.....
Southern California Edison—600,000 sh	.....	.....	Mar. 1(c)
California Oregon Power—300,000 sh	.....	.....	Mar. 2(d)
Utah Power & Light—200,000 sh	.....	.....	Mar. 23
Southern Indiana Gas & Electric—114,166 sh (to be offered commonholders on a 1-for-7 basis, record about Mar. 24 to expire April 9)	.....	.....	.....
Wisconsin Public Service—316,897 sh (to be offered commonholders on 1-for-7 basis)	.....	.....	.....
Missouri Public Service—527,854 sh (to be offered commonholders on a sh-for-sh basis)	.....	.....	.....(f)
Northern States Power (Minn.)—1,219,864 sh (to be offered commonholders on 1-for-10 basis)	.....	.....	.....

Notes—(a) First Boston Corp—W. C. Langley & Co—Blyth & Co group, underwriters; (b) Union Securities Corp—Smith Barney & Co, underwriters; (c) First Boston Corp—Dean Witter & Co group, underwriters; (d) Blyth & Co—First Boston Corp group, underwriters; and (f) Kidder Peabody & Co., underwriters.



VAULT INSTALLATION shows how transformer connections are made. Metering leads run in conduit through the end wall



CORE-AND-COIL ASSEMBLIES are mounted in a side frame cradle. Vacant space is for installation of an additional assembly

Pre-Assembled Units Reduce Vault Costs

HERBERT W. DORNBUSH, Distribution Design Engineer, Pennsylvania Transformer Co

Reduced cost of vault installations and ease of maintenance are obtained with a new pre-assembled transformer unit, called Power Pac Assembly. Field work is kept to a minimum, and a standardized installation provides three-phase or single and three-phase service to one or several customers. Duquesne Light Co, Pittsburgh, Pa., is one of the first utilities to make extensive use of the units, which embody either three or four standard distribution transformer core-and-core assemblies.

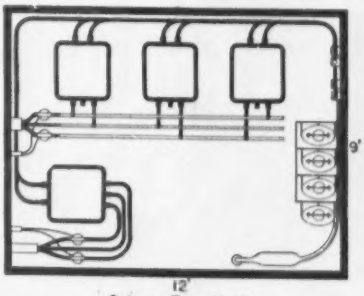
Power connections are simplified because core-coil assemblies are interconnected at the factory. Secondary leads are brought out through cover bushings eliminating the secondary bus otherwise required for separate single-phase transformers.

Short lengths of primary cable are installed through wiping sleeves from primary terminals within the case at the utility shop. This eliminates the external primary bus and permits a completely metal-clad primary wiring job for maximum safety. Primary protective links capacity encased in fibre tubing within the tank replace external cut outs.

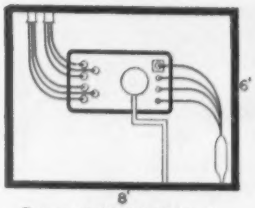
Metering connections are simplified for one customer installations by mounting current and, when needed, potential transformers within the tank. Metering leads are brought out to a terminal box at the center of the tank cover. Separate, sealable enclosures for metering transformers are eliminated.

When the pre-assembled unit serves several customers, metering transformers are omitted from the unit and installed on the customers' premises. In this case, a submersible thermometer is installed for load indication.

(*Continued on page* 122)



Subway Type Vault



Pre-assembled Unit Vault

LESS VAULT SPACE is required to install a pre-assembled transformer than is occupied by four single-phase transformers

CAPACITORS

MOUNT IN ANY POSITION

Complete air evacuation assures high dielectric strength

GENERAL ELECTRIC CAPACITORS ARE SMALLER, LIGHTER—MORE DEPENDABLE

Only 66 pounds for 25 kilovar, 2400-volt unit—saves weight on your poles—no sacrifice in quality

When installing capacitors you want dependability . . . plus ease of handling and installation. You get all three with General Electric Pyranol* capacitors.

RECENT TESTS ON G-E CAPACITORS manufactured in 1931, compared with original test records, reveal no change in electrical characteristics. Control of all materials used in construction provides this stability—for example, the dry-annealed aluminum foil used in G-E capacitors is thoroughly cleaned to remove oil and any contaminants. Complete evacuation prior to impregnation removes all air which could cause failure in service. Testing of each unit at every manufacturing stage assures control of quality and gives you a capacitor that will perform longer under the most severe service.

Easier installation is possible with lighter, smaller G-E capacitors. This reduction in size and weight is achieved with no sacrifice in quality.

Remember, whether you need to increase kw capacity of feeders, transformers, regulators, or the entire system back to the generators . . . whether you want to improve feeder voltage levels . . . reduce overall losses . . . or defer the expense of major changes in feeder layout, General Electric Pyranol capacitors are the practical low-cost solution.

Capacitors are the only items of major electrical equipment that cost less today than in 1940. No other electrical investment does so much for so little.

Why not investigate the values of G-E Pyranol capacitors today? Contact your G-E Apparatus Sales Representative or write General Electric Company, Section 441-7, Schenectady 5, New York.

*Registered trade-mark of General Electric Company

Progress is our most important product

GENERAL ELECTRIC

SMALLEST AND LIGHTEST

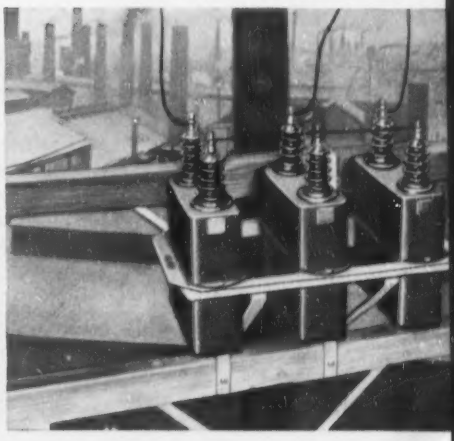
Easier to handle and install —unexcelled reliability

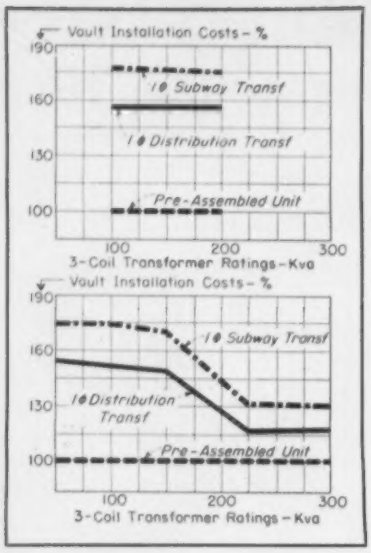
WELDED GLASS BUSHINGS

Provide high mechanical strength— permanent hermetic seal

TRIPLE-PROTECTED CASE

Protects even in corrosive atmosphere —cuts repainting expense





COST ANALYSIS for different vault installations shows that the pre-assembled transformer installations cost less

Pre-Assembled Units

(*Continued from page* 119)

Use of the units reduces vault size requirements. Two pre-assembled units can be placed in a vault that formerly contained a bank of single-phase transformers, thus doubling capacity without additional vault cost.

When necessitated by load increase or failure of a core-coil assembly, another unit can be installed in a very short time with little or no inconvience to the customer. Much of the material already installed may be left in place for re-use with the new unit.

Because standard distribution transformer core-coil assemblies are mounted in a frame designed to accommodate various size combinations, modifications for other secondary voltages can be accomplished easily. Another core-coil assembly can be added to convert a three-phase unit to a combination single/three-phase unit. Components that fail are replaced quickly.

Although cost of the pre-assembled unit is about that of subway-type equipment, analysis by one utility revealed that substantial savings are realized using the pre-assembled units wherever possible. Accompanying curves show the relative costs for vault installations including equipment, vaults, fuses, installation material, and labor.

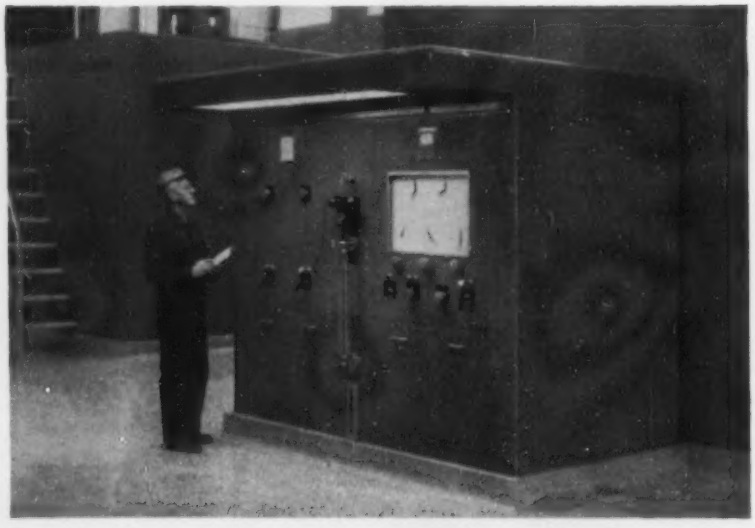
Generator Saves $45,000 Running As Synchronous Condenser

JAMES KEZER, Asst. Supt. of Operations, South Platte River District, Bureau of Reclamation, Denver, Colo.

Operation of a 16,666-kva hydro generator as a synchronous condenser reduced system losses on the Bureau of Reclamation's system in Wyoming and Colorado by an estimated $45,000. Installed in the Estes Power Plant of the Colorado-Big Thompson project, the unit was disconnected from its hydraulic turbine and operated almost continuously over a period of 18 months to supply needed reactive.

Conditions on the Bureau's system in 1952 were such that large amounts of leading reactive kva had to be supplied, and voltage control at the southwest portion of the system was imperative. The main generation came from plants in central Wyoming over long 115-kv lines. Estes Plant was the only source of reactive power available.

Because the project was in its developmental stage, the three units at Estes were run for reactive supply. Generation was scheduled to provide power for peaking and emergencies. During operation at zero load, water trapped in the draft tube was constantly churned by the turbine runner and caused very high losses, running up to 1,300 kw. If the water were bled from the draft tube, losses would be reduced to about 3-400 kw.

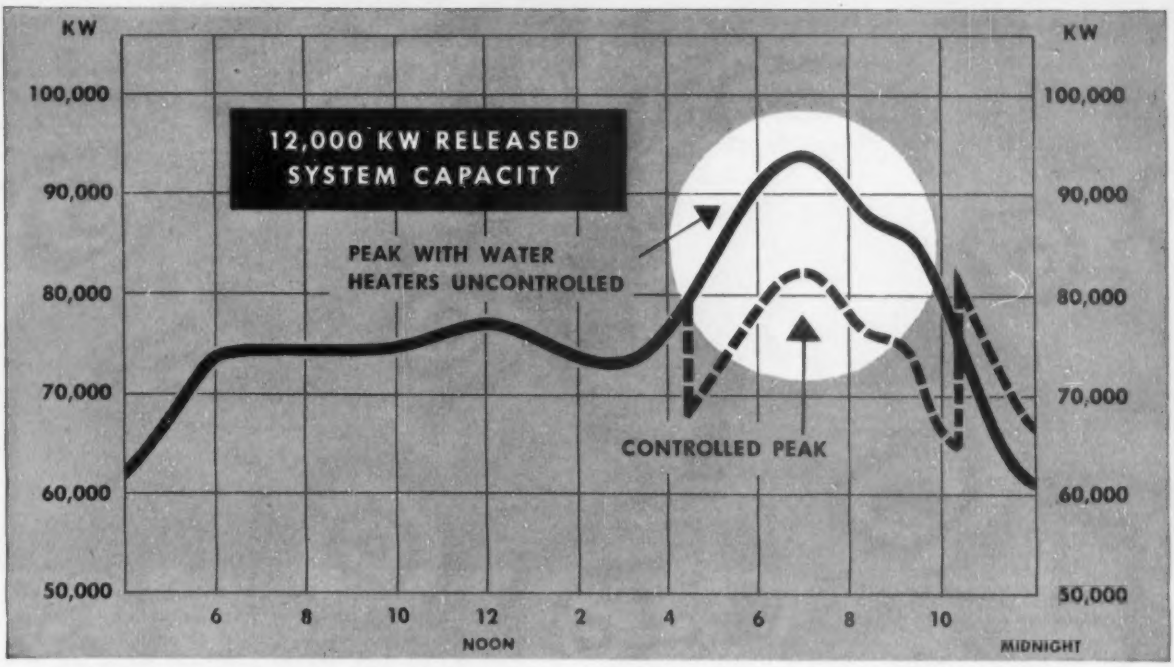


NEEDED REACTIVE KVA was fed into the Reclamation Bureau's system by disconnecting Estes Power Plant's Unit No. 3 from its turbine and running it as a synchronous motor

However, no practical method of bleeding the water could be found. Because one machine could be spared for exclusive use as a condenser, it was decided to disconnect the turbine and run a generator as a synchronous motor. A method of starting the synchronous-condenser unit remained to be set up.

The three units at Estes are arranged on the "unit system" with circuit breakers on the 115-kv side of the power transformers. Main and transfer buses are installed with one transfer breaker on Unit No. 1. A starting procedure was set up using Unit No. 3 as the synchronous machine. It was isolated from the system and connected through disconnects to the transfer bus with its field breaker left closed. Also isolated, Unit No. 1 was run at about half normal speed with voltage regulators closed in and produced about half-rated voltage. When the transfer breaker was closed, Unit No. 3 broke away and Unit No. 1 speed and voltage were gradually

(*Continued on page* 126)



DAILY LOAD CURVE SHOWS RELEASED LOAD THROUGH USE OF ECONOMICAL G-E TIME SWITCH OFF-PEAK CONTROL

Improve System Operation with G-E Time Switch Control of Electric Water Heaters

The electric water heater load, growing by an estimated 2,400,000-000 KW hours per year, is one of the few loads utility management can control for profitable load building. By automatically cutting off the electric water heaters on your system during peak periods with General Electric time switch off-peak control, you reduce the peak load and receive these benefits:

RELEASED SYSTEM CAPACITY

You can release capacity into your electrical system with time switch off-peak control equal to the number of electric water heaters on your system multiplied by 0.6 KW (average KW demand per heater).

INCREASED SYSTEM LOAD FACTOR

With time switch off-peak control, more kilowatt hours can be sold without exceeding the peak demand, and the return on your system investment is greatly increased.

LOWER INVESTMENT COSTS

To serve new water heater loads, it is unnecessary to install new capacity—your only system investment is in time switch off-peak control.

G-E TIME SWITCH CONTROL

Both of the G-E time switches, the T-43 and the TGW-2, offer low-cost, flexible off-peak control.

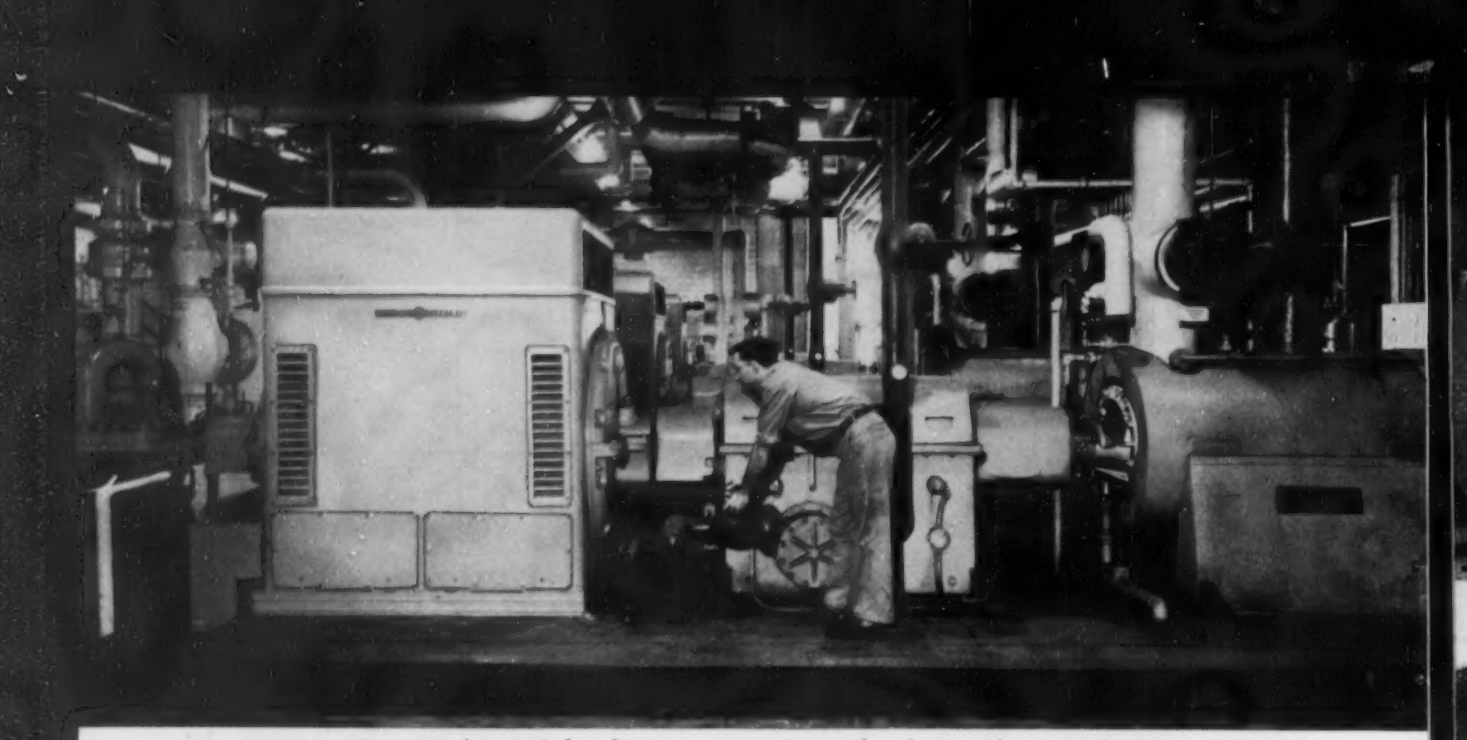
FOR MORE INFORMATION

Contact your General Electric Apparatus Sales Office. A representative will be glad to discuss, in terms of your needs, any one of G.E.'s off-peak control systems: combination watthour meter-time switch, 720-cycle control, or time switch. Also write for Bulletins GEC-474A and GEC-705B to Section 603-176, General Electric Company, Schenectady 5, New York.

T-43 TIME SWITCH is lightweight, easily mounted indoors or outdoors; preset at factory to purchaser's schedule; available with external reset.

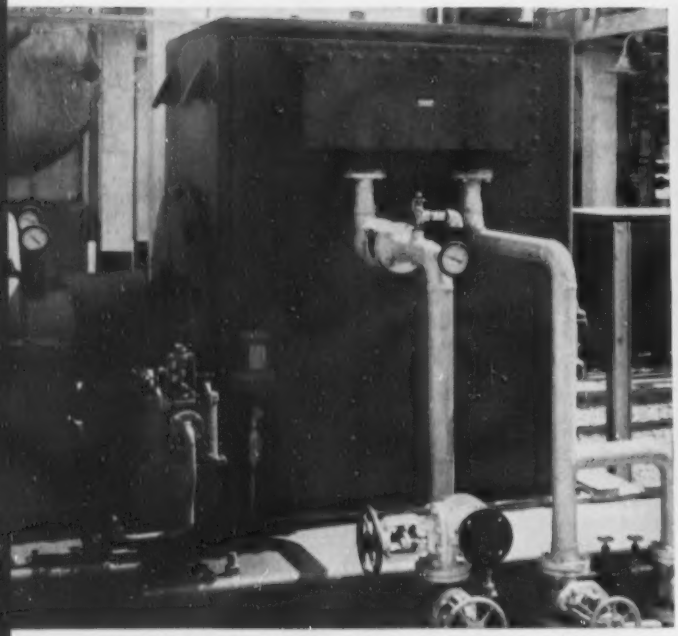
TGW-2 TIME SWITCH uses same base and cover as Type I-50 watthour meter; accurate setting is simplified by easily-used sealable openings.

GENERAL ELECTRIC

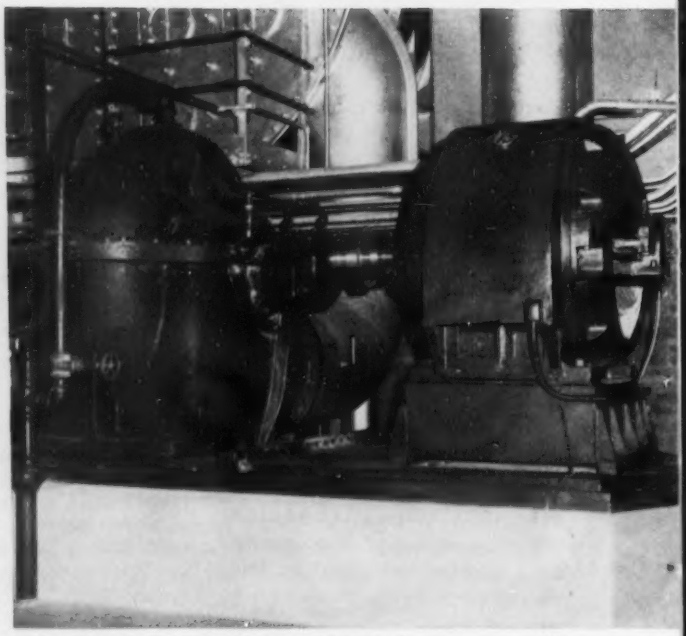


G-E BOILER FEED PUMP MOTORS in a typical application at Detroit Edison's Connor's Creek Plant. Designed especially for boiler feed pump service, 1000 hp ratings and larger, this motor permits closer spacing because of unique ventilating system and cubical shape . . . conserves floor space. You get improved performance from streamlined rotor design which also gives quieter operation. Dual lubrication system combines the advantages of force-flood lubrication and self-lubricated oil rings. Modern appearance blends with power station styling. Write for Bulletin GEA-5813.

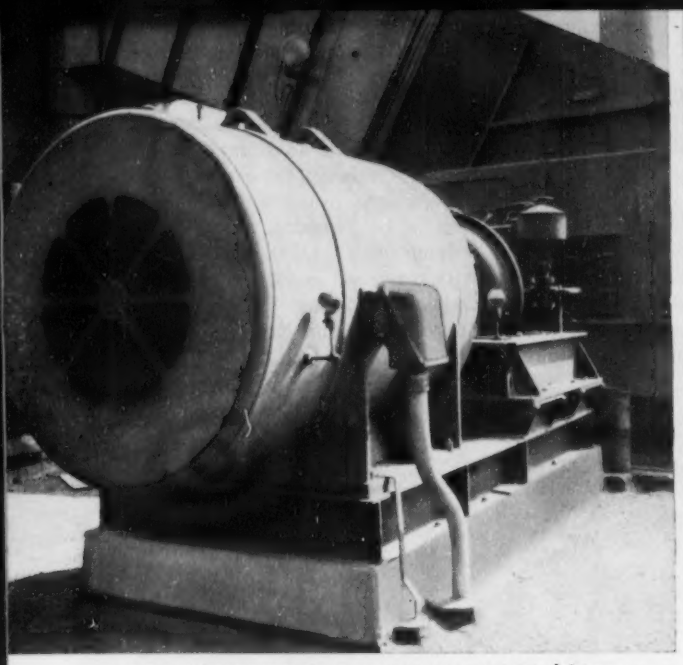
Proved Motor Dependability



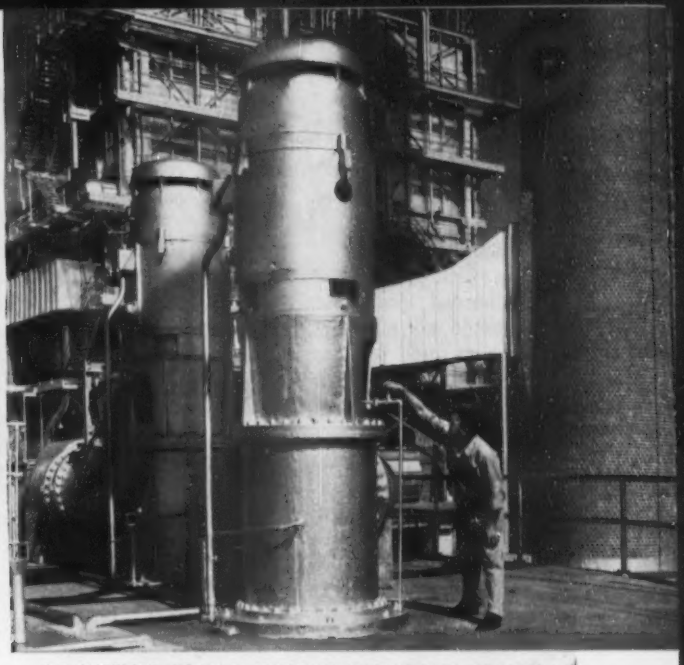
G-E TOTALLY ENCLOSED AIR-WATER COOLED MOTOR is an economical choice for 250 hp and larger. Simple to install, it needs no ducts, filters or blowers. Total enclosure means less maintenance by keeping out dust and other foreign particles. Shown here driving blower in a Kansas plant.



LARGE G-E OPEN DRIPPROOF MOTORS, four or more poles, such as this one coupled to circulating water pump in Cliffside Steam Station of Duke Power Company, are designed for indoor applications only. They are widely used on hot well pumps, forced- and induced-draft fans, and coal pulverizers.

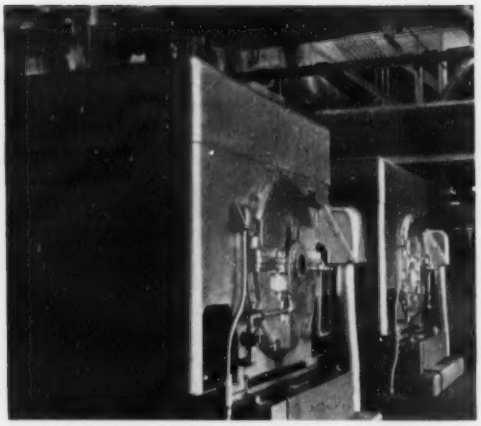


THIS G-E TOTALLY ENCLOSED FAN-COOLED MOTOR drives an induced-draft fan in the Edwardsport Steam-electric Power Station of Public Service Company of Indiana. Total enclosure assures the ultimate in motor protection required for operation in severe atmospheric conditions.



G-E VERTICAL TOTALLY ENCLOSED FAN-COOLED MOTORS, with Tri-Clad* construction, such as these driving pumps at New Orleans Public Service Inc., A. B. Paterson Steam-electric Generating Station, are used for dependable, low-maintenance service in severe ambient conditions.

for Power Station Service



TWO G-E WEATHER PROTECTED MOTORS, grade mounted, driving boiler feed pumps at Florida Power & Light Company's Cutler Plant. Available also in vertical and base ventilated design, this low-cost motor is designed especially for outdoor service where the extra protection of totally enclosed fan-cooled design is not economically justified. Bulletin GEA-5810.

*Reg. Trade-mark of General Electric Co.

G.E.'s complete line of power station auxiliary motors—field proved—assures you of getting the right motor for every operating requirement and station design.

Power stations across the country have installed dependable G-E motors for every auxiliary use. Because of the extensive field study that General Electric has devoted to power station requirements and the engineering experience gained through building all types of power station equipment for over 70 years, you are always assured of getting the right motor for economical and dependable service.

Whatever your needs in power station motors, General Electric can furnish the right type and size from a complete line . . . a wide variety of designs, enclosures, and application variations. You get exactly the motor needed to meet conditions of your operating practice, economics or location.

For more information on G.E.'s complete line of power station auxiliary motors contact your nearest G-E Apparatus Sales Office. *General Electric Co., Schenectady 5, N. Y.* 751-6

GENERAL ELECTRIC

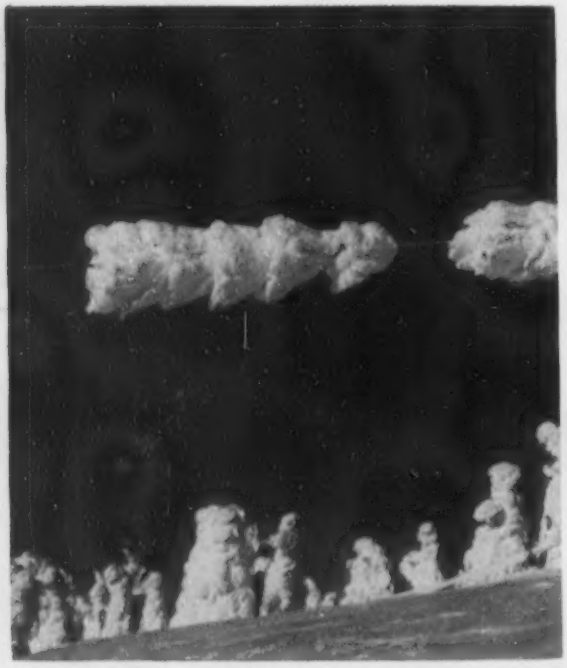
Generator

(*Continued from page* 122)

increased. It was possible to hold armature current quite low while accelerating Unit No. 3.

Units synchronized at about three-fourths normal speed when the field in the motor unit built up. The driving machine speed was dropped back slightly and the units pulled into step very smoothly. Then they were brought up to normal speed together, synchronized to the system, and Unit No. 1 was dropped off.

Except for occasional short periods, and a few outages caused by system troubles that isolated the Estes plant and required re-starting, the unit was operated continuously for over 18 months. Subsequently, it was coupled and uncoupled two or three times and used a few weeks at a time as a generator or a motor as system conditions dictated. Although full capacity of the machine was available for boosting, most of its running time required bucking with 11,000 kva available. With the recent installation of a synchronous condenser on the system, future use of Unit No. 3 as a motor will be limited.



Trouble from ice and snow . . .

is buried along with cable as . . .

Co-op Chooses Underground for Mountain Top

Underground cable up the side of a mountain will eliminate outages during winter months on a line serving two installations that require an extremely high degree of service reliability. The cable represents the last 2,900 ft of a 7.2-kv line built to the top of Mt. Spokane by Inland Empire Rural Electrification, Inc, Spokane, Wash.

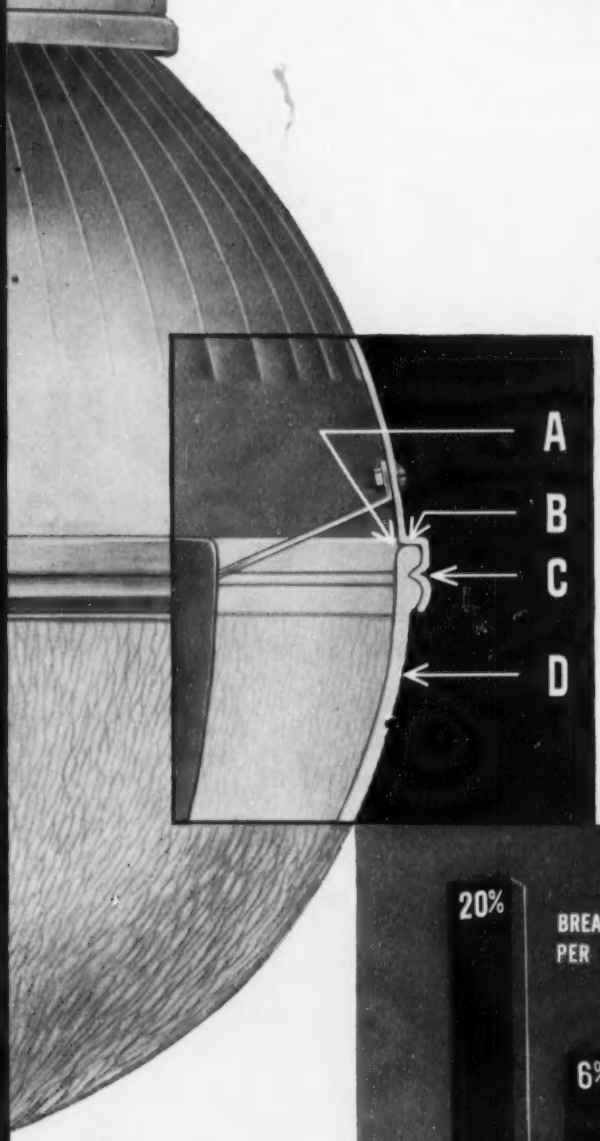
The new installation replaces an overhead line of high-strength steel conductor carried on heavy pole structures originally built in 1940. During subsequent winters, the steel conductor broke under the strain of heavy ice and snow loads. As the line now serves a BPA microwave station and the new KXLY-TV transmitter, outages could not be tolerated, especially during the winter.

Cable chosen for maximum reliability is a 3-conductor, No. 4, 19-strand semi-conducting type, with copper shield on individual conductors that are twisted together with fillers and No. 8 ground wires in the interstices. Each conductor is covered with 27/64-in. butyl-base insulation. Cable is bound with metal tape and finished off with a No. 6 galvanized steel wire. Capacity of the cable is 15 kva to allow for future expansion of the present 3.75-kva load.

The cable was shipped in one 1,800-ft length and one 1,100-ft length to stay within size and weight limitations for transportation up the steep mountain grade. Longer length was hauled to the mountain top first and unreeled beside an 18-in. deep trench. Line crews then lifted the cable into the trench. After the second section was unreeled and positioned, the cable was spliced and covered.

Total cost of the job was $30,000, including cost of the cable, installation, and terminal facilities at the top of the mountain. Total installation time of about two weeks included two days each for trenching, cable laying, and back-filling. Wiring at the terminal and completing the connection took one week.

Cut glassware breakage up to 80% with G-E spun-sealed luminaires



Replacing glassware for G-E spun-sealed street-lighting luminaires costs an average of 12 cents per luminaire **per year.** Compare that to replacement costs for ordinary glassware, in the comparison chart below, and you will see why G-E optical assemblies with the exclusive G-E spun-sealed design have brought amazing savings wherever they have been adopted.

In addition to greatly reduced glassware breakage—in service and in shipment—G-E spun-sealed assembly keeps glassware interiors clean for more efficient light utilization, and completely eliminates chipping of the refractor edge.

The economical, practical advantages of spun-sealed design are available on all standard G-E fixtures.

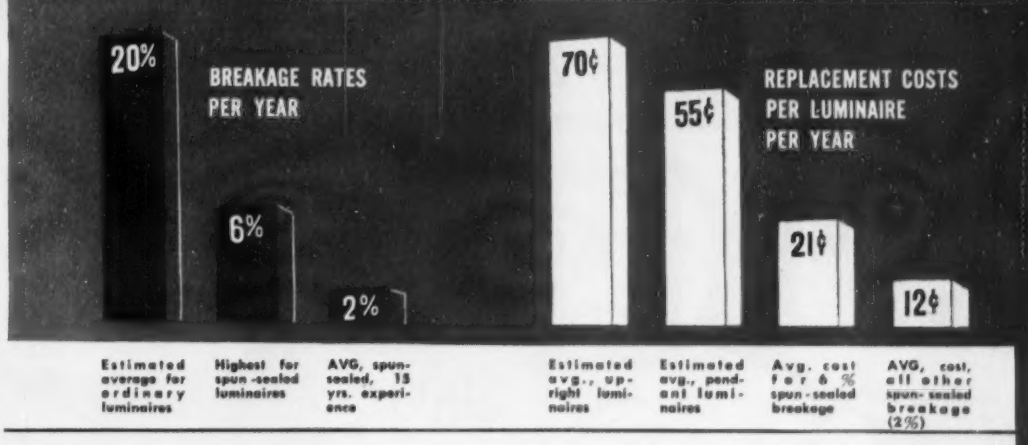
For more information on how you can benefit by using G-E spun-sealed optical assemblies, contact your nearby G-E Apparatus Sales Office, or Authorized G-E Street-lighting Agent. General Electric Company, Schenectady 5, N. Y. 452-138

A. No gasket at weatherproof joint reduces maintenance costs.

B. Reflector fully protects glassware lip from damage in shipping and storage.

C. Spinning operation weeds out any defective glassware at factory.

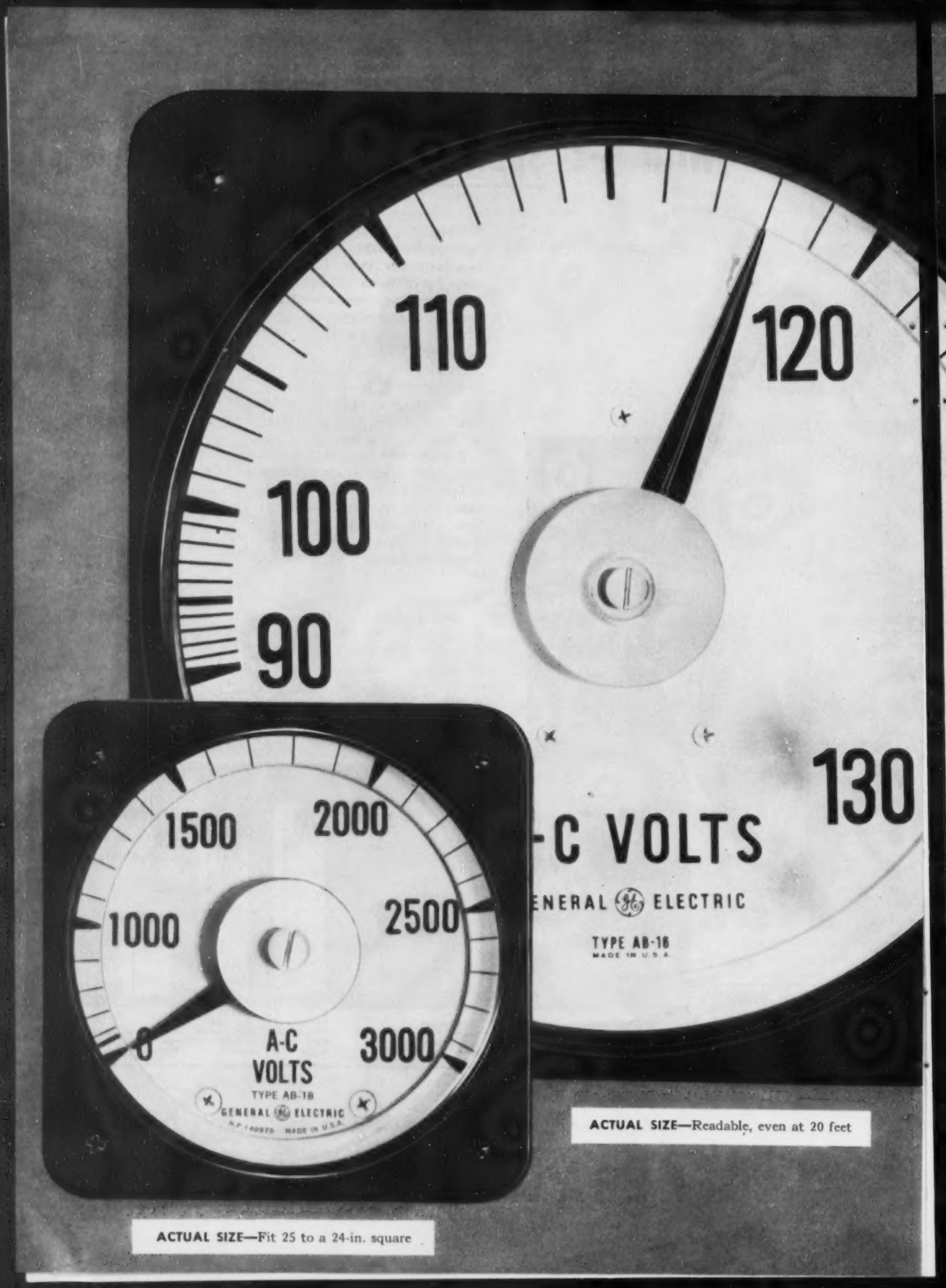
D. Pressed globes and refractors have exceptional strength and uniformity.



Quality lighting at less cost with G-E engineered equipment.

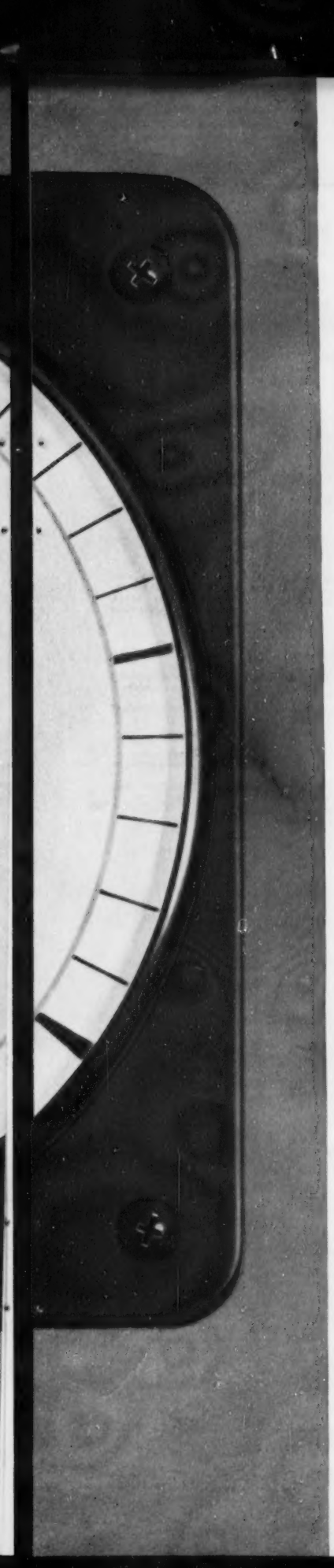
You can put your confidence in—

GENERAL ELECTRIC



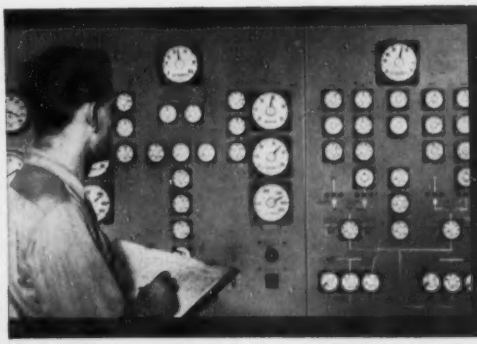
ACTUAL SIZE—Readable, even at 20 feet

ACTUAL SIZE—Fit 25 to a 24-in. square



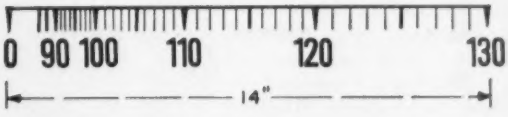
BIG, FOR READABILITY—SMALL, FOR BEST USE OF SPACE

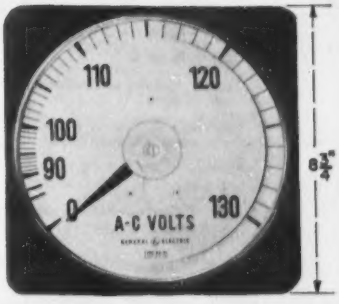
G-E Long-scale Instruments Are Sized to Your Needs



TELESCOPIC READABILITY makes the General Electric 8¾-in. instrument ideal for locations where convenience dictates taking readings at long distances.

OPTIMUM USE OF SPACE is realized with the 4¼-in. miniature. Twenty-five of these can be mounted in a 24-in. square, without any decrease in readability.





LONG CIRCULAR SCALE is straightened out above to show you why G-E instruments—big or small—are easy to read. A fourteen-inch scale on the 8¾-in. instrument and a full seven-inch scale on the 4¼-in. instrument are possible because each scale has a 250° arc. Readability is further increased by a raised, convex window, which floods the shadow-proof scale with light from all sides.

For further details, contact your nearest G-E Apparatus Sales representative or send the coupon shown at right for a copy of Bulletin GEC-218.

SECTION A602-275
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, NEW YORK

Please send me a copy of your bulletin on the AB-DB-18 and AB-DB-16 long-scale switchboard instruments (GEC-218).

Name .....

Company .....

Street .....

City ..... Zone ..... State .....

GENERAL ELECTRIC

Properties of Some Bronze Alloys

A quick reference tabulation of chemical composition, common uses, general and working properties and characteristics of common bronze alloys

Data furnished by Revere Copper and Brass Inc

Alloy Name	Aluminum Bronze, 5%[1]	Aluminum Silicon Bronze[1]	Phosphor Bronze, 5%[1]	Phosphor Bronze, 8%[1]	Bearing Bronze[1]
Chemical Composition[1]					
Copper	95.0	91.0	95.0	92.0	90.0
Zinc	.....	.....	.....	.....	9.5
Aluminum	5.0	7.0	.....	.....	.....
Arsenic	0.035	0.035	.....	.....	.....
Tin	.....	.....	5.0	8.0	0.5
Silicon	.....	2.0	.....	.....	.....
Typical Uses	Condenser tubes	Bolts, nuts, gears, pinions, valve bushings, bodies and stems, high strength forgings, tie bolts, marine hardware, sucker rods, hardware bushings	Fuse clips, diaphragms, bellows, lock washers, clutch discs, springs, screw machine stock, expansion plates	Fuse clips, springs, perforated sheets, bellows, cotter pins, bushings, lock washers	Fuse clips, lamp connections, bushing material for light loads, weatherstrip applications
General Properties	High physical properties High resistance to acids	Unusually high tensile strength Excellent corrosion resistance	High tensile strength High resistance to corrosion and fatigue	High corrosion and fatigue resistance Low friction coefficient	High physical properties Resistant to atmospheric corrosion and tarnish
	Most resistant of the bronzes to H_2S	Readily hot forged, rolled and extruded Free machining	Low friction coefficient; high immunity to season cracking	High tensile strength	Low friction coefficient
Working Properties					
1. Cold-working	1. Good	1. Poor	1. Excellent	1. Excellent	1. Excellent
2. Hot-working	2. Good	2. Excellent	2. Poor	2. Poor	2. Excellent if lead-free
3. Machining	3. Fair	3. Excellent	3. Fair	3. Fair	3. Fair
4. Welding	4. Gas, carbon arc, metal arc	4. Gas, carbon arc, metal arc	4. Gas, carbon arc, metal arc—spot and seam for thin gauge	4. Gas, carbon arc, metal arc—spot and seam for thin gauge	4. Gas, carbon arc, metal arc
5. Soldering	5. Good	5. Fair	5. Excellent	5. Excellent	5. Excellent
6. Polishing	6. Good	6. Excellent	6. Excellent	6. Excellent	6. Excellent
Density, lb per cu in	0.295	0.278	0.320	0.318	0.318
Young's Modulus of Elasticity, psi, $\times 10^{-6}$	17	14	16	16	15
Coefficient of Thermal Expansion per deg F (68 to 570 F)	0.0000099	0.0000092	0.0000099	0.0000101	0.0000102
Electrical Conductivity, % IAC at 68 F	18	7	18	13	39
Thermal Conductivity, Btu per sq ft per ft per hr per deg F at 68 F	48	22	47	36	100
Tensile Strength, 1000 psi	Hard Soft	Hard Soft	Hard[2] Soft	Hard[3] Soft	Hard Soft
sheet	.. ..	.. ..	98 47	116 55	65 45
rod	.. ..	.. 80	70 ..	.. ..	.. ..
tube	70 50	.. ..	.. ..	.. ..	.. ..
Elongation, % in 2 in.					
sheet	.. 64	.. ..	5 64	5 70	5 42
rod	.. ..	.. 20	25 ..	.. ..	.. ..
tube	25 60	.. ..	.. ..	.. ..	.. ..
Yield Strength, 1000 psi					
0.5% extension under load					
sheet	.. ..	.. ..	76 22	75 ..	62 14
rod	.. ..	.. 43	64 ..	.. ..	.. ..
tube	45 ..	.. ..	.. ..	.. ..	.. ..
0.2% offset					
sheet	.. ..	.. ..	91 22	112 ..	62 14
rod	.. ..	.. 43	64 ..	.. ..	.. ..
tube	30 ..	.. ..	.. ..	.. ..	.. ..
Rockwell Hardness No.					
sheet	.. 72F	.. ..	91B 73F	100B 75F	76B 55F
rod	.. ..	.. 80B	78B ..	.. ..	.. ..
tube	80B 55F	.. ..	.. ..	.. ..	.. ..
ASTM Specifications					
sheet	..	..	B100, B103	B100, B103	Tests conducted on 0.040 in. stock. Basis of rating, hard on material previously rolled 6 B&S nos. Grain at ready to finish 0.080–0.150 mm, soft annealed at 1300 F for one hour.
rod	..	B124, B150	B139, B159	B139, B159	
tube	B111	..	..	..	

Basis of rating: sheet, hard—0.0400-in. stock previously rolled 4 B&S numbers hard (37.5% area reduction).
Basis of rating: rod, hard—1 (one) in. and under diameter, previously drawn through 20%—25% area reduction.
[1] The values listed represent reasonable approximations suitable for general engineering use. Due to commercial variations in composition and to manufacturing limitations, they should not be used for specification purposes. See applicable ASTM specification references.
[2] Sheet, springtemper—0.040 in. stock, previously rolled 8 B&S numbers hard (60.5% area reduction)

You can get from **Revere** much more than **Tubes** and **Plates**

Because no one alloy can possibly meet all the various conditions of use, Revere makes condenser and heat exchanger tubes and plates in many different alloys. From its long experience Revere is able to give valuable collaboration on alloy selection.

Sometimes puzzling problems arise in operation. If tubes do not last as long as expected, consult Revere, no matter who made them. Sections of failed tubes will be helpful in determining causes.

In our experience, the main cause for shortened tube life is a change, or combination of changes, in operating conditions. The water supply may have been affected by a new source of up-stream pollution. Air entrainment is especially damaging and leaves unmistakable marks. Air can be drawn in through a leaky gasket. In one case, the source was traced back to a crack in the water pump casting. Occasionally we find that tube failure is due to increasing the water velocity beyond design limits in order to add to condenser capacity.

For a more comprehensive analysis of condenser tubes and what Revere can do for buyers and users of them, send for free booklet, "Life Extension for Condenser Tubes." See the nearest Revere Sales Office, or write direct.

REVERE

COPPER AND BRASS INCORPORATED

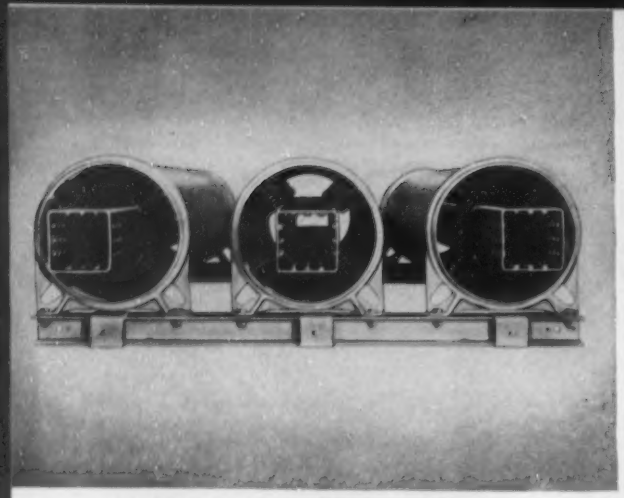
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

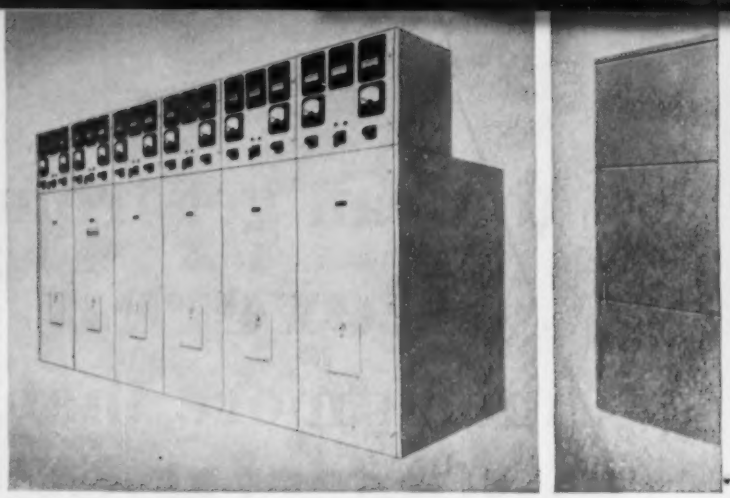
• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

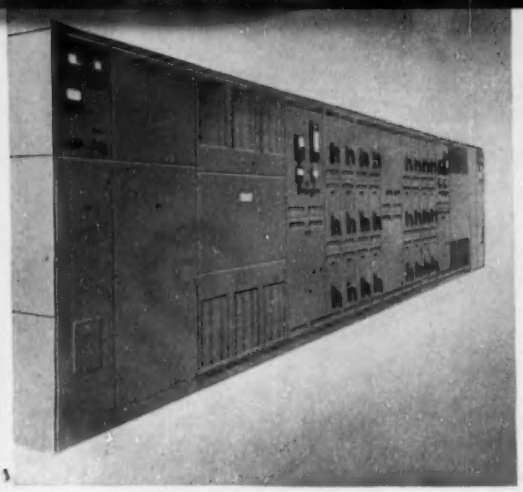


METAL-ENCLOSED BUS STRUCTURES

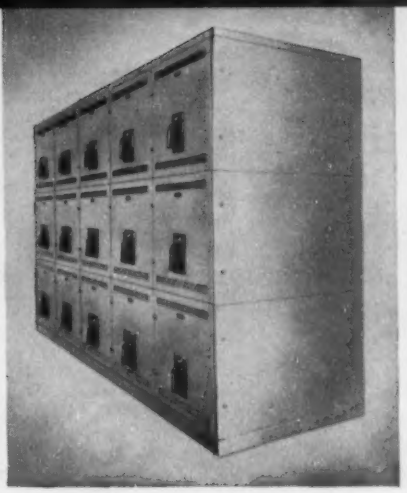


METAL-CLAD SWITCHGEAR

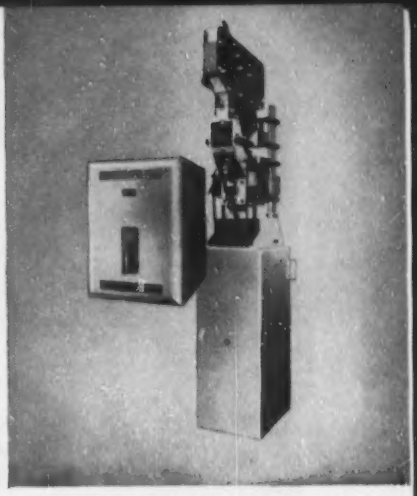
Put I-T-E



UNIT SUBSTATIONS



LOW-VOLTAGE SWITCHGEAR



LARGE AIR CIRCUIT BREAKERS

in your power plans...

for Dependability, Safety, and Over-all Economy

A complete line of Quality Switchgear Equipment

From generation to utilization, I-T-E quality equipment serves every industrial and commercial application. Whether your plans include bus structures, metal-clad or low-voltage switchgear, unit substations, or individual circuit breakers—you are assured of I-T-E's many *extra-service* benefits, which include:

1. **selection and application of equipment**
2. **preparation of specifications**
3. **coordination of all job requirements**

Power is fundamental in any new plant construction or expansion. Power distribution systems must be planned to assure maximum dependability of service, safety for personnel and equipment, and *over-all* economy—from initial planning . . . through the life of the equipment.

Furthermore, it is important to plan power systems with an eye to the future. They should be adaptable to changing plant requirements for many years ahead.

For these reasons, it pays to include I-T-E quality products in your power plans. For over 65 years I-T-E has set the standard for the industry—through engineering skill, design refinement, and introduction of new ideas and thinking.

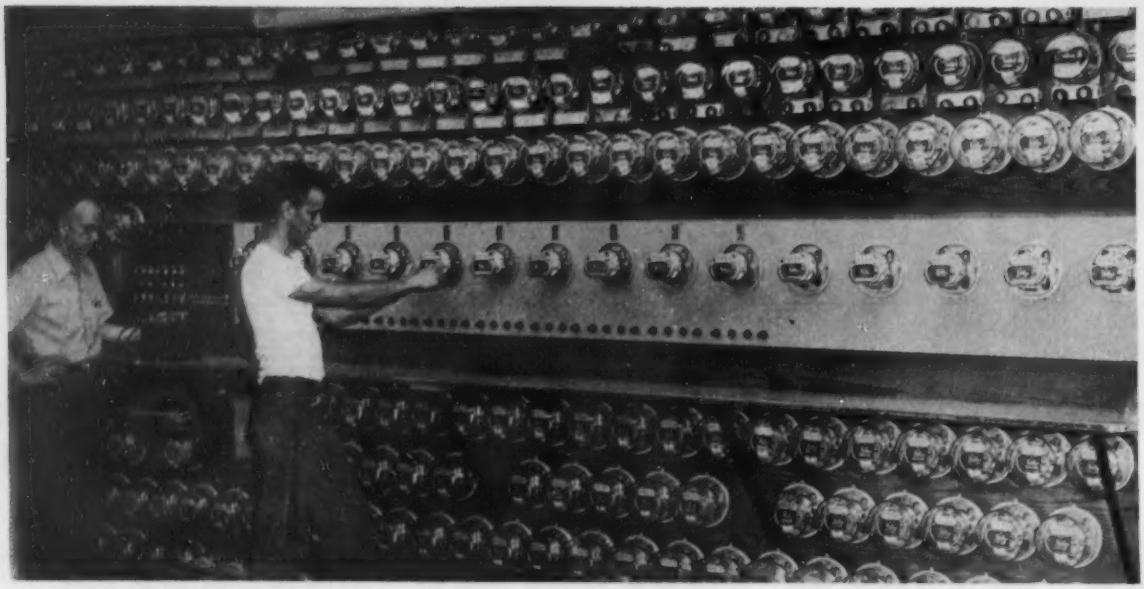
For details, contact the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

SWITCHGEAR PRODUCTS



METER TEST BOARD checks as many as 200 watthour meters per man per day at Frederick, Md. A similar test board is at Hagerstown

Test Boards Check 15 Meters Simultaneously

J. BAKER, System Meterman, Potomac Edison Co, Hagerstown, Md.

Two watthour meter test boards, designed and constructed by company personnel, help Potomac Edison Co make checks of from one to fifteen meters at one time.

These gang meter testing boards are used by the company in two locations, Hagerstown and Fredericksburg. They handle socket and "A" base meters. Approximately 200 new meters per man per day can be effectively inspected and adjusted.

Accuracy checks are made on all new meters. Every fourth week a Public Service Commission representative inspects and marks all meters before installation.

For the accuracy checks the boards use a multi-secondary transformer with a phantom load equipped for changing from light load to full load and 0.5 power factor, without removing connections.

As meters are received by the utility, they are removed from their cartons, numbered, tagged, tested, and adjusted. Thus, without loss of time and with minimum handling, meters are made ready for use.

Used meters are tested, repaired and adjusted in another part of the shop. A final inspection and accuracy check is then made on this board by the P.S.C. representative, thus making the meters ready for installation as required.

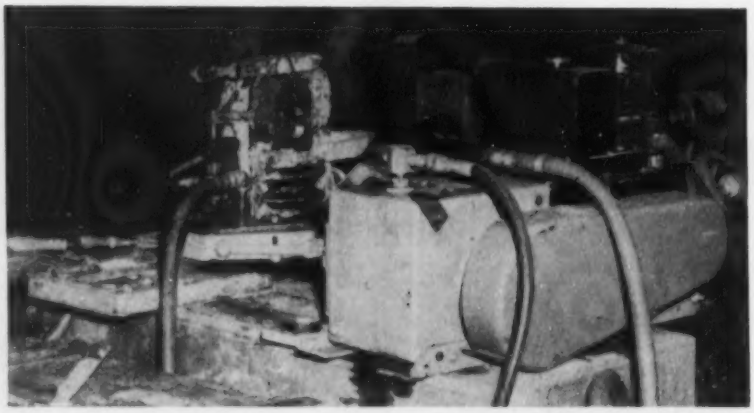
Powered Press Cuts Compressing Time 85%

N. W. CURTIS, Electrical Construction Foreman, Pennsylvania Power & Light Co, Allentown, Pa.

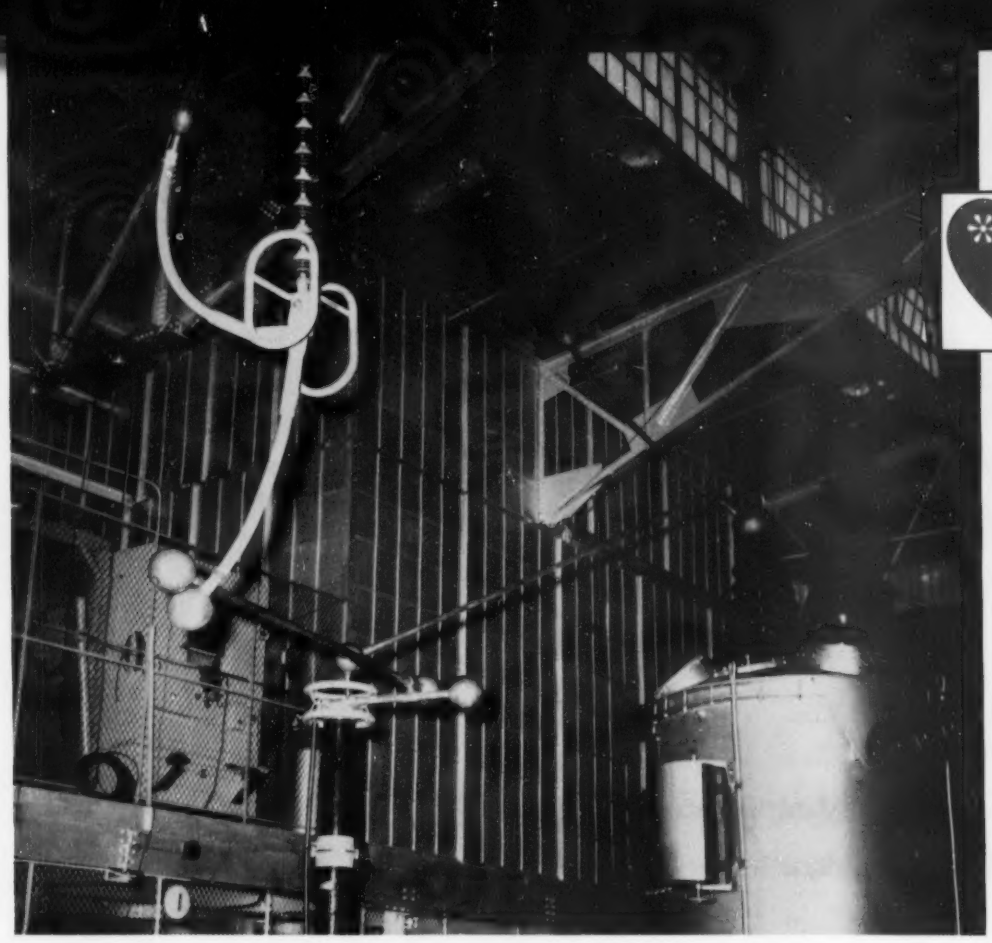
An engine-driven hydraulic press eliminated much of the manual work and saved time during installation of over 400 aluminum cable compression terminations at Hosensack Substation. Pennsylvania Power & Light Co found that labor savings during first week of operations justified cost of the unit.

Aluminum deadends that normally required 15 min to compress by hand were completed in 2 min with the power press. Average time required

(*Continued on page* 139)



HYDRAULIC PRESS is powered by a pump that is coupled to a gasoline engine. Pumping unit can also be used with a hydraulic bender for bending large-size conduit



Better than a cat-eyed technician in a darkroom

Ordinary corona observation in total darkness is one of the oldest high voltage laboratory procedures for detecting electrical over-stress on insulators and hardware. This test has the advantage of permitting the observer to visualize the phenomenon, and is therefore still of definite value. But it has the disadvantage of lacking precise measurement and is dependent on human eyesight. Now, the O-B Laboratory literally measures electrical over-stress with a micrometer. Instruments replace eyes and, in broad daylight, are infinitely better than the best cat-eyed technician in a darkroom.

Such precision research has resulted, for example, in the design of a 330-kv shield that permits the use of conventional conductor hardware, yet suppresses substantially all electrical over-stress adjacent to the lower end of the insulator string. One way of doing such a job might be on a "cut-and-try" basis, leading to a gradual process of elimination. The other way is to attack the problem directly, in the design stage, and produce a finished sample that is right the first time! This freedom from being forced to "go fishing" for answers is one of the best examples of O-B's Technical Competence.

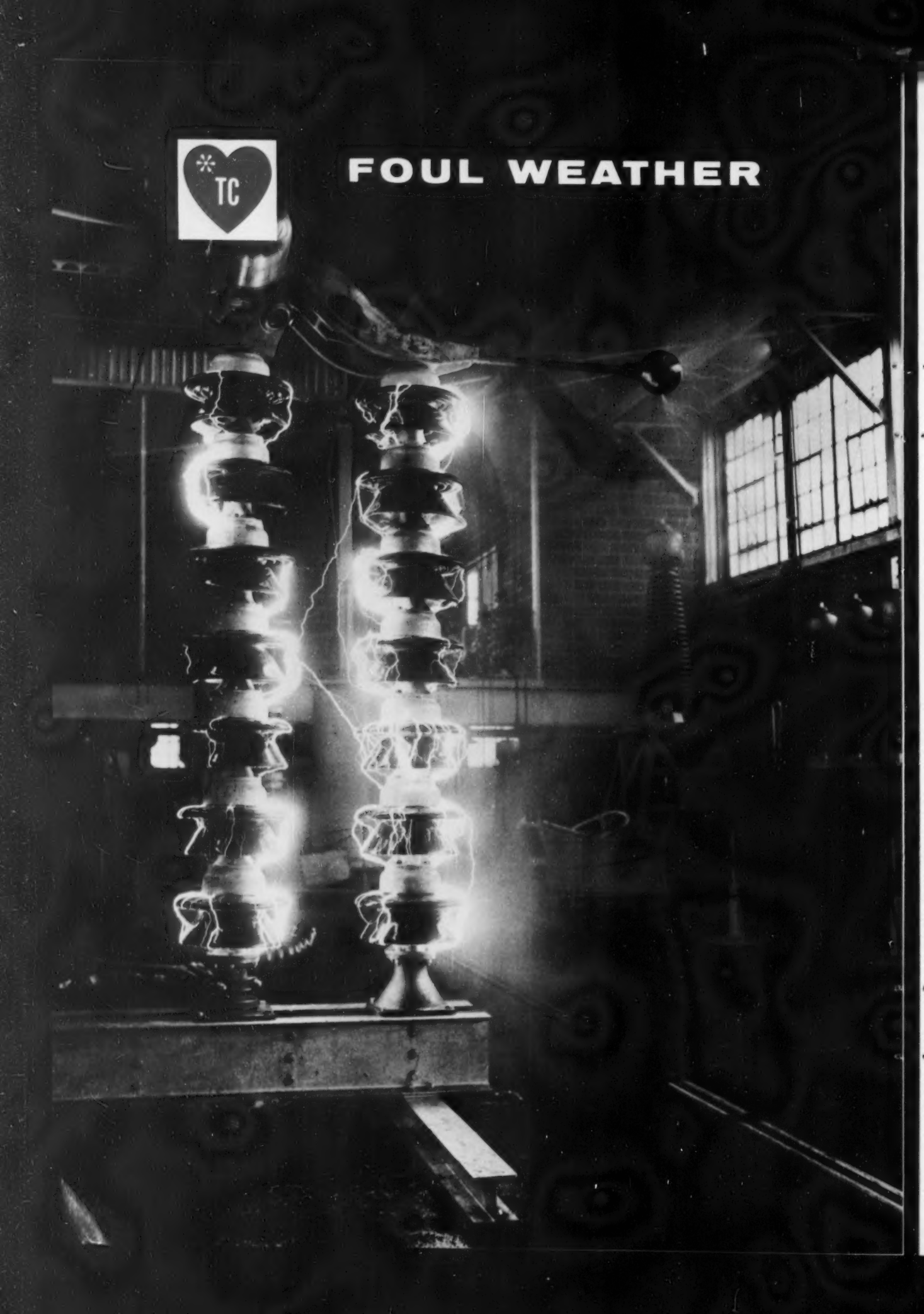
Laboratory equipment and facilities, however, are only the physical side of this story. There is more to it. There is the valuable and somewhat unique attitude of recognizing the interdependence of insulators and hardware by men who habitually deal with the combination as designers, manufacturers, and researchers. There is the "green light" supplied by management which fosters and promotes technical advancement. There are also two factors affecting the buyer: First, a recognition that insulators and hardware consist of more than porcelain and metal. Second, that such fine technical facilities work to the ultimate benefit of all insulator and hardware users, and are made possible by your continuing support.

OHIO BRASS COMPANY, MANSFIELD, OHIO

In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

TECHNICAL COMPETENCE

the heart of all *Ohio Brass* hardware


TC
FOUL WEATHER

Was Just One of the Test Requirements

It took "a bit of doing" to build this air-break switch for service above 300 kv. The switch manufacturer was working on the borders of virgin territory. His final design had to be confirmed, and he took advantage of the facilities of the O-B High Voltage Laboratory which are available to all members of the Electrical Industry.

This switch was erected on the Laboratory test floor. They first wanted a rain storm, so we produced it. Then they wanted power-frequency flashover, so we flashed it at 60 cycles, as the picture shows. While this is heavy testing, much more important is the engineering experience that evaluated the results against a background of having performed a multitude of tests relating to the insulation problems of extra-high-voltage transmission.

While O-B has produced insulators for all present projects above 300 kv, of more real significance is the basic research we have conducted in this new field. The special facilities and skills to do this effectively emphasize the fact that, while materials and processes may be the necessary mechanics of an insulator, Technical Competence is the heart of it!

"At the Sound of the Bell . . ."

Sometimes the big steep-wave impulse generator in the O-B Electrical Laboratory runs throughout the day, firing about every 15 seconds. We use the word "firing" advisedly as it rivals a respectable cannon. A few hours of this would have every man in the place a nervous wreck.

-- But a little two-bit door-bell saves the day. It's wired into the impulse generator trigger circuit to ring a couple of seconds before the blast occurs. Men react to its weak little voice unconsciously. It lets them know what's coming. They go about their business as if nothing were happening, instead of jumping half out of their skins.

Applying common sense to common problems is the daily diet of O-B laboratory men. This door-bell may not make our insulators any better, but the man who *thought of the door-bell* proved once more that research consists of other things besides mathematics -- one of which is using your head!

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

the heart of every *Ohio Brass* insulator

It's a matter of

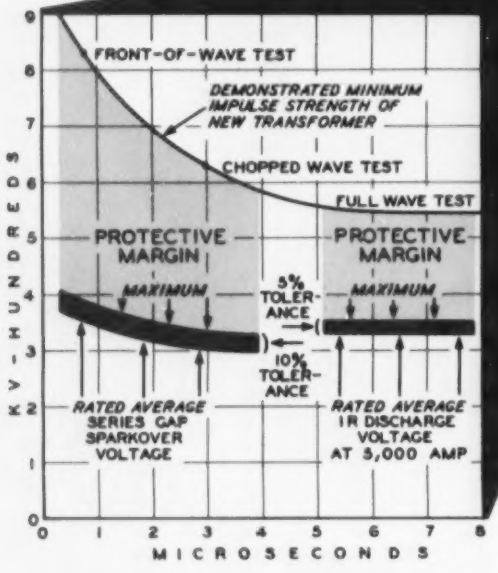
PLAIN

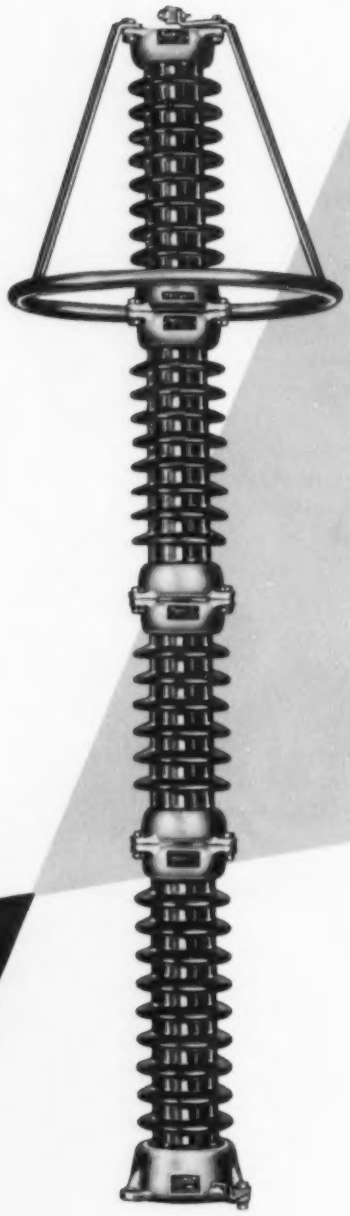
PROTECTION!

In the final analysis, a lightning arrester is just as good -- and no better -- than the protection it provides. And putting the Thorex story in a nutshell, this arrester gives you *both* the greatest protection per dollar, as well as the greatest protection regardless of price!

For the safety of primary loads and major equipment, and for maximum assurance of adequate Protective Margins*, your soundest lightning arrester choice, today, is the O-B Thorex.

*Protective Margin, as illustrated in this typical application curve, is that zone existing between MAXIMUM arrester protective rating (tolerance added to average rating) and minimum insulation strength of equipment.





Ohio Brass

MANSFIELD OHIO • U. S. A.

4408-H

Powered Press

(*Continued from page* 134)

to apply a 1,192,000 cir mil deadend body with steel clevis was reduced from 25 min to less than 10 min.

Powered press consists of a press coupled to a hydraulic pump that is powered by a gasoline engine. An automatic governor on the engine and a pressure cutout on the pump limit the equipment to the rated operating pressure of the press.

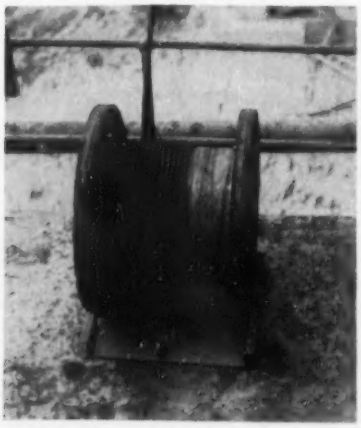
All equipment, weighing about 400 lb, was mounted on a small trailer, and towed about the job site. Fittings were compressed onto the cable on the ground.

Hydraulic power unit has also been used with a hydraulic bender for bending large sizes of steel conduit and copper tubing. Here, also, the time required to complete an operation was cut to a fraction of that required by manual methods that were formerly used.

Cable Life Increased on Coal-Unloading Tower

GEORGE K. BROWN, Supervisor of Operations, Tanners Creek Plant, Indiana & Michigan Electric Co, Lawrenceburg, Ind.

A method of reducing wire-cable expense more than 50% per 1,000 tons of coal handled distributes the wear due to the sheaves more evenly over the hoisting line. The gross saving has been $1.12 per 1,000 tons. Hence, with three units in service and a coal consumption of approximately 4,500 tons per day, the annual saving



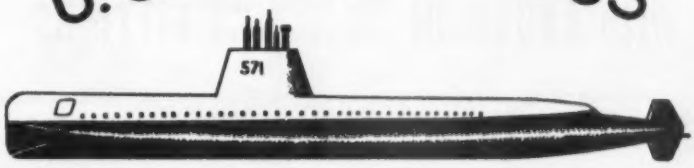
FREE-ROLLING REEL on coal-unloading tower holds reserve hoisting cable

.....another Shawmut first

Amp-traps*

For

U.S.S. NAUTILUS



FIRST NUCLEAR POWERED SUBMARINE

...How about letting Amp-traps stop dangerous short circuits for you?

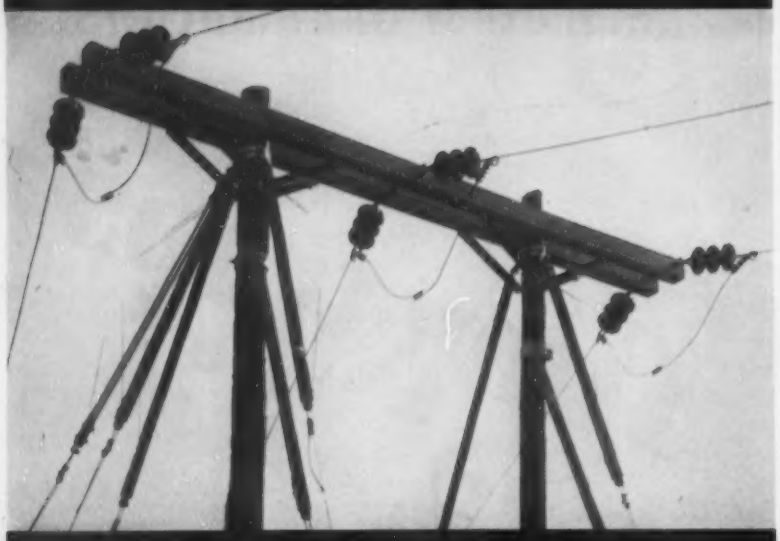
In Canada — Powerlite Devices, LTD.

©The Chase-Shawmut Co. 1953

*Trade Mark

THE CHASE-SHAWMUT CO., NEWBURYPORT, MASSACHUSETTS

PUT UP



AND STAY UP

with LAUGHLIN drop forged steel hot galvanized FITTINGS

Transmission or distribution - guys stay put when they're fastened with Laughlin fittings. Their extra strength, extra quality makes them outlast ordinary fittings on every job. Try them yourself — and see!

SAFETY "FISTGRIP" WIRE ROPE CLIPS

Drop forged steel, hot galvanized, with standard heavy hex nuts. Foolproof, identical saddles can't be put on wrong. Fewer clips needed, holding power is greater than with conventional clips. Sizes for strand diameter from 3/16" to ⅝" Smooth Bore, 3/16" to 1½" with Rifled Bore.

CLEVISES

Round Pin Chain
Round Pin Anchor

Weldless, drop forged steel, available with screw pins, round pins with cotter, hex head bolts and nuts with cotter. Sizes from ¼" to 3"

THIMBLES

Wrought steel, galvanized, in both regular weight and heavy plow steel. Open Guy Thimbles stocked in ⅜", ½" and ⅝" sizes.

TURNBUCKLES

Sturdy drop forged steel, weldless, hot galvanized. Available in: (1) hook and eye, (2) eye and eye, (3) jaw and eye, (4) hook and hook, (5) jaw and jaw. Heavy reins with hex ends, precision threading. Exclusive eye design takes shackle one size smaller than turnbuckle diameter. Sizes (diameter & takeup) ¼"x4" to 2¾"x24".

These are only part of Laughlin's complete line of over 1500 types and sizes of wire rope and chain fittings. The line also includes safety hooks, wire rope sockets, swivels, double clevis links and weldless rings.

For complete data, ask for Catalog 155. Laughlin fittings are available through leading distributors everywhere.

Photo courtesy Charles E. Eaton

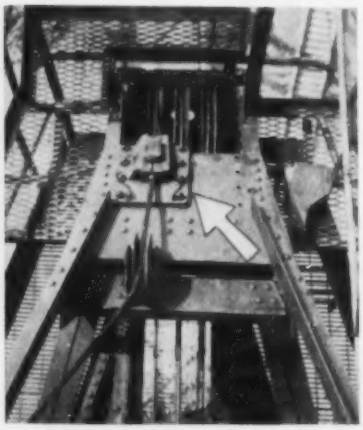
LAUGHLIN

THE THOMAS LAUGHLIN COMPANY
226 Fore Street, Portland, Maine

will be approximately $1,800.

Previously the average life of a 387-ft, ⅞-in. wire-rope hoisting line on the plant's coal-unloading tower was only 100,000 tons. This is based on using 6 x 36 special crane cable costing $221.75, or $2.22 per 1,000 tons of coal unloaded. Replacement of the cable is determined by the wear on approximately 50 ft of its central portion that passes through the bucket sheaves.

Now a 1000-ft wire rope reel is mounted on a roller-cradle in the tower. With customary precautions, the rope is reeved through a dead-end clamp on the tower, then through the sheaves on the trolley and bucket and attached to the hoisting drum. After the required amount of wire is wound on the drum, the lower clamp is tightened.



DEAD-END CLAMP on tower holds hoisting cable, is loosened to move cable toward drum and distribute wear

After unloading 20,000 to 25,000 tons of coal, the drum attachment and dead-end clamp are loosened so that the worn section of the hoisting line can be moved closer to the drum about 1¼ ft per 1,000 tons of coal unloaded. That amount of rope is cut off at the drum end, the cable reattached, and the tower end clamped again. This operation is performed after every additional 25,000 tons of coal hoisted. Even after all the rope is pulled off the storage reel, 50,000 tons of coal can still be unloaded at the tower with the last section of hoisting line.

With this procedure 540,000 tons of coal can be unloaded by using a 1,000-ft reel of wire rope costing

(*Continued on page* 144)

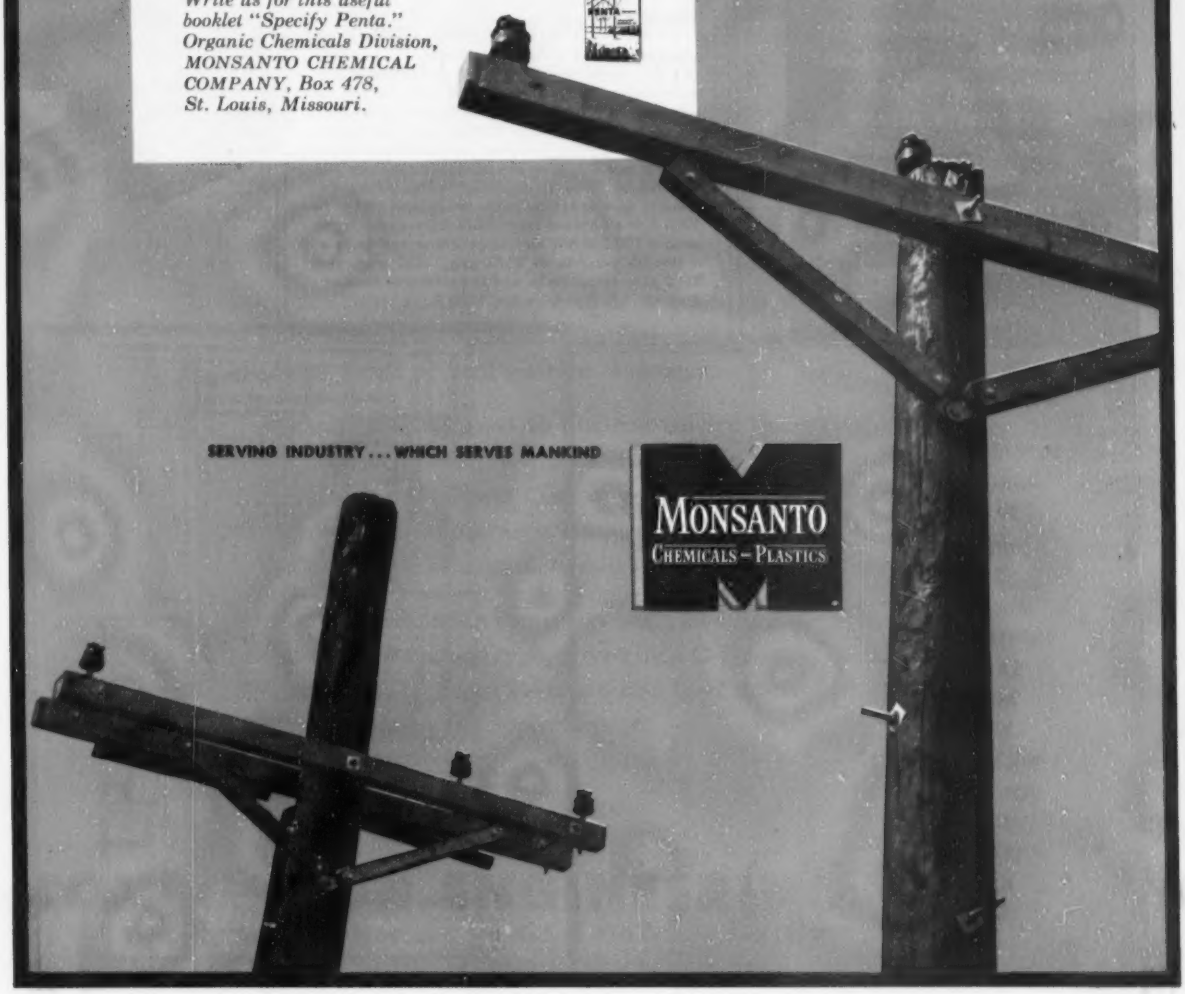
For Pacific Gas & Electric—

MONSANTO PENTA GIVES WOOD 4 LIVES

POLES AND CROSSARMS treated with Monsanto Penta will have at least four times the service life of untreated materials. Penta—on the job for Pacific Gas & Electric Company—protects wood against decay and insect attack for many years.

LINEMEN LIKE PENTA-TREATED WOOD. It's clean, easy to handle, does not irritate the skin or "burn" hands. Penta in wood is not messy, will not bleed out to stain clothing. It leaves wood paintable if specified. When you specify Penta, you protect your investment in a farsighted way: well-preserved, clean poles are an asset.

Write us for this useful booklet "Specify Penta." Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478, St. Louis, Missouri.



SERVING INDUSTRY . . . WHICH SERVES MANKIND

MONSANTO
CHEMICALS – PLASTICS

NEW UTILITY STATIONS C-E EQUIPPED

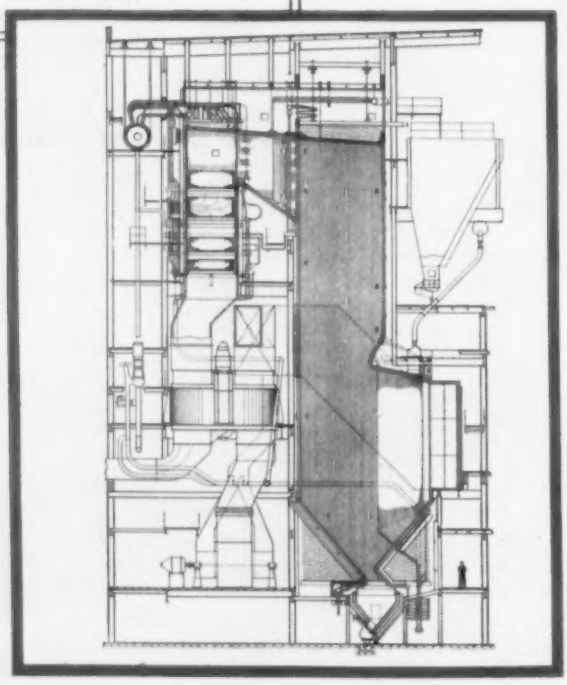
Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA
HENNEPIN • EASTLAKE

OAK CREEK

SUWANNEE RIVER
URQUHART
SANDOW
KINGSTON
BARRY
MULLERGREN
NORTH OMAHA
SAGUARO
MILLIKEN
NELSON
WILMINGTON
JOHN SEVIER
VERMILION
GALLATIN
BARRETT
CARBON

The C-E unit shown is now in service at the Oak Creek Station. A duplicate unit is presently under construction, and a third is on order. The units are of the controlled-circulation, radiant-convection superheater, radiant-reheat type, with the radiant reheater section located on the furnace side walls. An economizer section is located below the evaporating section in the last pass, and two regenerative type air heaters follow the economizer surface. Bin and feeder firing is employed, using differential firing in four under-arch cells to regulate reheat to 1000 F at all normal loads. Each successive unit will serve a 120,000 KW turbine generator operating at a throttle pressure of 1575 psig, 1800 psig, and 2000 psig, respectively, and steam throttle temperatures of 1000 F, reheated to 1000 F.



NEW OAK CREEK STATION

Goes into service

Oak Creek Station of the Wisconsin Electric Power Company went into service recently when the first of four units was synchronized.

Located about 16 miles south of Milwaukee on the west shore of Lake Michigan, this station is strategically situated to serve the electrical needs of Southeastern Wisconsin.

The station was designed by and constructed under the supervision of the engineering and operating staffs of the Wisconsin Electric Power Company. It is of functional design, combining good appearance, simplicity, and ruggedness; without sacrifice of efficiency, reliability or economics.

The initial installation comprises one 120,000 KW turbine generator of the reheat type, served by a C-E controlled circulation boiler, a cross-sectional elevation and brief description of which appears on the opposite page.

B-726

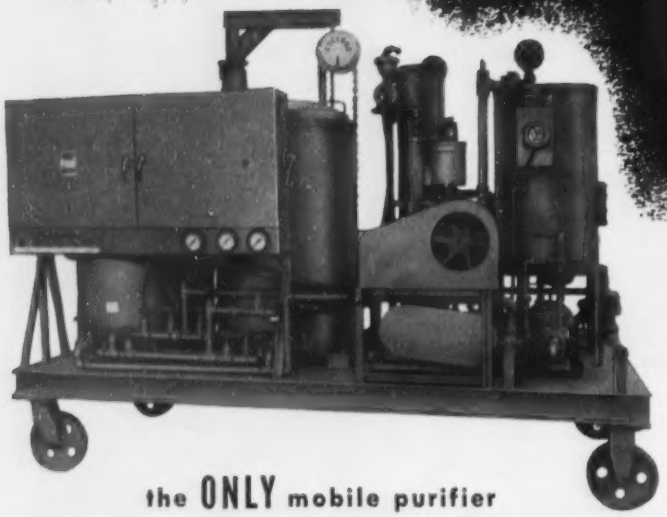
COMBUSTION ENGINEERING, INC.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

Get Automatic
Low Cost Purification
of Insulating Oils
in
TRANSFORMERS, CIRCUIT
BREAKERS, SWITCH GEAR AND
OTHER OIL FILLED EQUIPMENT

with the
Houdaille
Purivac



the ONLY mobile purifier
on the market that . . .

1. Performs complete purification, dehydration and degasification in one automatic operation with complete safety!
2. Operates in the field (without taking electrical equipment out of service) or at a central station.
3. Eliminates costly transformer cleaning operations . . . restores color, neutralization number and dielectric strength of oil.
4. Extends useful life of oil . . . reduces power failures and equipment damage.
5. Insures complete protection with automatic interlocking safety controls.

Here are some of the many companies using PURIVAC oil purification to reduce power failures and equipment damage caused by deteriorated oil. Only Houdaille Purivac gives you complete oil purification service.

CENTRAL MAINE POWER CO.
CINCINNATI GAS & ELECTRIC CO.
CITY OF LOS ANGELES
DOBLE ENGINEERING CO.
EASTERN SHORE PUBLIC SERVICE
INDUSTRIAL RAYON
IOWA PUBLIC SERVICE CO.
KANSAS GAS & ELECTRIC
MEMPHIS POWER & LIGHT
MINNKOTA ELECTRIC SERVICE CO.
NATIONAL LEAD COMPANY
NORTHERN STATES POWER
OMAHA PUBLIC SERVICE DISTRICT
PENNSYLVANIA POWER & LIGHT
PHILADELPHIA ELECTRIC CO.
PORTLAND ELECTRIC CO.
PUBLIC SERVICE OF INDIANA
QUEBEC HYDRO-ELECTRIC COMMISSION
WESTINGHOUSE ELECTRIC INTERNATIONAL

WRITE TODAY for equipment bulletin and complete specifications.

Honan-Crane Corp.
819 Wabash Ave., Lebanon, Indiana
a subsidiary of
Houdaille-Hershey Corp.

WORLD'S LEADING
OIL FILTER MANUFACTURER

Cable Life

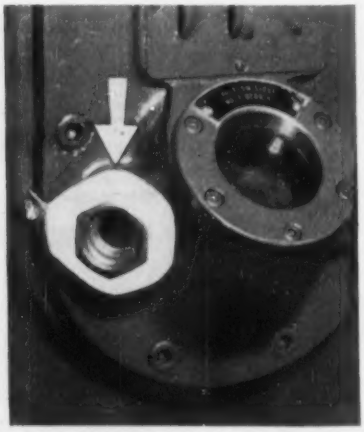
(*Continued from page* 140)

$593. Hence the rope cost is now $1.10 per 1,000 tons unloaded, or a saving of $1.12 per 1,000 tons over the former method of replacing each 387-ft rope when badly worn. Approximately the same man-hours are required per 1,000 tons of coal hoisted for changes with either method.

The cable reel roller-cradle required for starting the new method cost $37.50. The annual saving of $1,800 for three units would be greater with a reel containing a longer cable, but the size of the reel is limited by the tower. The next reel that will be used will contain 1,500 ft of cable.

Lock Eliminates Fire Hazard

One type of fire hazard was eliminated in Central Power & Light Co's La Palma Station at San Benito, Texas, by application of a thermometer well safety lock. The lock was designed by Joe Fortson, maintenance foreman. It prevents loosening of the well due to vibration or accidental unscrewing when the thermometer is removed for testing. It, therefore, prevents loss of oil through the well which would create a fire hazard.



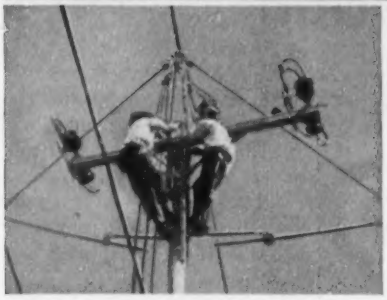
SAFETY LOCK fits over thermometer well and is bolted in place. It prevents accidental loosening of the well and resultant spilling of oil which would create fire hazard

For installations on pipes, the safety lock may be made in the form of a band around the pipe.

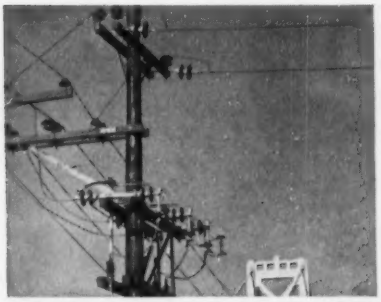
KPF

AIR BREAK SWITCHES

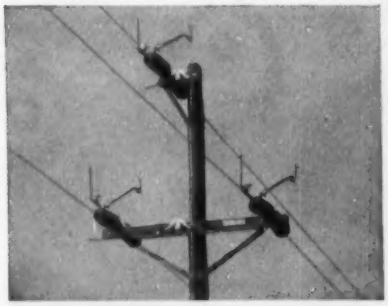
Standard for nearly half a century



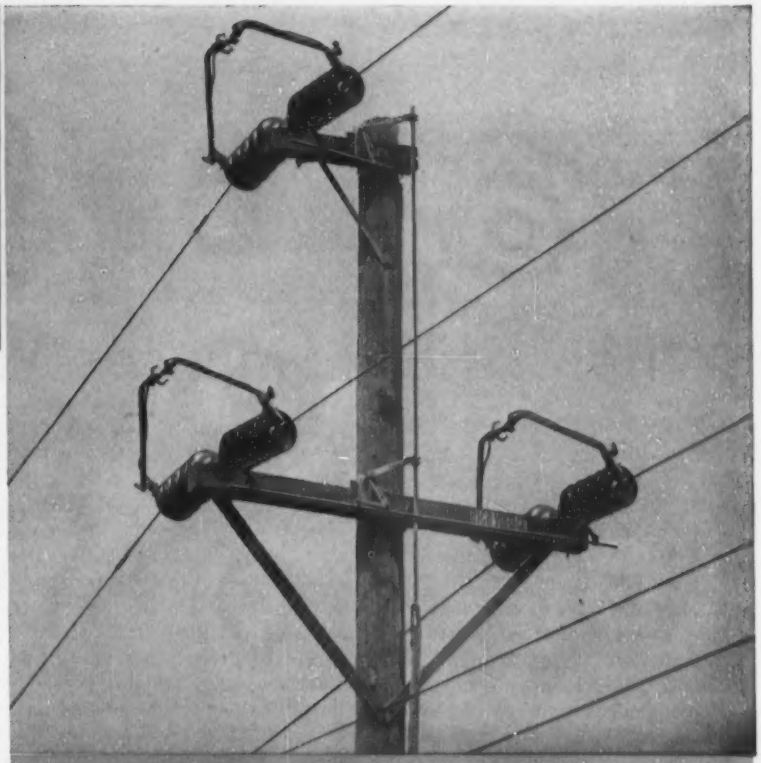
Installing KPF Type A-202 switch hot on 12 kv line. KPF phase units are shipped completely assembled, ready for quick installation.



Horizontal-mounted KPF Type UF-2 switch in metropolitan service (P.G.&E., San Francisco). Versatile KPF switches operate equally well with or without line tension.



KPF Type S-205 switches with inexpensive Quick-Break attachment on 60 kv rural transmission line. Switch shown in open position.



Basically different switch design proven in decades of service with leading utilities

Service-proved KPF switches look different because they *are* different.

Their simple, sturdy design insures freedom from mechanical failure or lubrication worries, and virtually eliminates maintenance. Self-aligning silver surfaced blades operate smoothly despite severe ice or crossarm warpage conditions. Installation is fast and economical—switches are bolted directly to crossarms on the ground or in the air. No separate strain insulators or extra crossarms are required; integral insulator stacks readily adjust to line sag.

KPF switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies throughout the world.

For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

KPF ELECTRIC COMPANY

1624 East Alpine Avenue, Dept. E-1, Stockton 5, California

You Have NO PAIN in your pocketbook

When Utility Finances Wiring

To break the bottleneck of inadequate wiring in the appliance sales field, Cincinnati Gas & Electric Co has launched a program for financing wiring changes in existing homes. The first 60 days of the program resulted in the financing of 81 rewiring jobs having a total cost of more than $17,000. Jobs ranged from $40 to $600 and averaged $210 each. They were done by 52 different contractors.

The plan is very simple. It is based on the credit rating of the home owner and applies to any home already being served by the company. Wiring can consist of any and all changes, from the service entrance to the appliance connection, such as changing from a two-wire to a three-wire service, increasing the capacity of service entrance and main line switch or adding circuits and outlets. Permanent lighting fixtures and the incidental plumbing in connection with an electric water heater installation also are included. The installation of a major appliance at the time of the wiring change is not required.

How It Works . . . The owner and the electrical contractor reach an agreement on the work to be done. The owner executes a note to the contractor covering contract price plus interest to date of maturity. He agrees to pay in 12, 24 or 36 monthly installments. Contractor and home owner then execute an agreement that the contractor assign the note to the Cincinnati Gas & Electric Co and the home owner agrees to pay the monthly installments as a part of his regular electric bill.

The company then checks the owner's credit rating and if satisfactory executes the agreement. One copy is mailed to the home owner and one copy to the contractor.

Minimum monthly payment is $2. Financing is handled by Cincinnati Gas & Electric without outside assistance. Interest is at standard FHA rates. In the case of rental property, the agreement is with the property owner.

Publicity is being given to the plan through billboards, car cards, newspapers, radio and television spots. Slugs have been provided for use by any contractor or dealer who wishes to include the plan in his advertising.

Plans call for increasing publicity by Cincinnati Gas & Electric and promotional efforts by contractors and appliance dealers. The company plans to send a descriptive folder to every customer who reports electric trouble where it is found that the cause was inadequate wiring.

Cincinnati Gas & Electric finance plan is explained to home owners and contractors by wiring advisers

How to Win Friends and Save Money

The fewer your customers' service interruptions, the fewer your trouble calls. The fewer trouble calls, the better your public relations. Self-supporting aerial cables are one of your public relations best friends.

They give you more circuits per pole, and less maintenance. You can install them on existing pole lines and thus lower your installation costs. For your customers, they mean greater safety, more attractive appearance, and fewer service interruptions. Best of all, they let you save money. Lots of it.

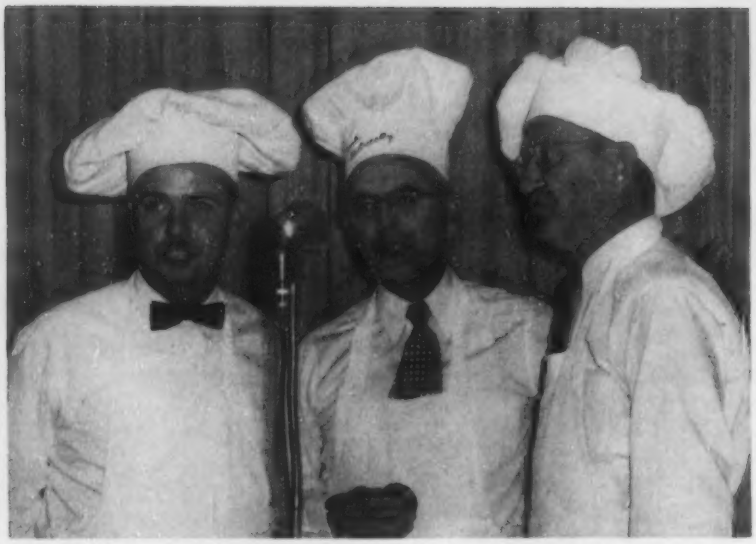
Simplex Self-Supporting Aerial Cables have a tough neoprene jacket that withstands abrasion from swaying tree limbs and chafing against poles. They provide effective protection against fungus, heat, sunlight, and weathering.

If you want to know more about what's in it for you and for your customers, write to the address below for Catalog 1006, or ask your Simplex representative for a copy of the Simplex Aerial Cable Catalog.

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE COMPANY

79 Sidney St., Cambridge 39, Massachusetts



EXTOLLING ELECTRIC COOKING at "Home on the Range" are, left to right: Ken Gibbons, Shel Bascom and Phil Brown of Union Electric's trade cooperation section. Comic song parodies were a feature of electrical rally for distributors and dealers last fall.

Rally Theme: We Tell 'Em; You Sell 'Em

More than 1,000 electrical appliance distributors and dealers attended three sessions of Union Electric Co's Fall Electrical Rally at which the fall sales promotion program was announced. The meetings were held last September.

Feature of the fall activity was a "Flameless Electric Range Contest" with a promotional tie-in with Duncan Hines.

Each person entering the contest received a box of Duncan Hines Blueberry muffin mix.

Winners in the contest received an electric range. Distributors and dealers received cash awards after accruing points for ranges sold during the campaign.

Informal talks, slide presentations, plus comic song parodies were used to put across the contest idea and sales promotion program with the assembled distributors and dealers.

Additional to announcement of the range campaign promotion plans for water heaters and clothes dryers and for electric housewares as gifts were explained in detail to the assembled dealers.

Material covered included newspaper advertising, radio and TV presentations, car cards, billboards and a large array of window streamers, counter cards, handout pieces for point-of-sale use.

Closing the meetings with a summary of the fall activity, Robert L. Coe, residential sales manager, exhorted the congregation to:

"Put up the display materials that we're sending to you. Use them! They'll help you do a real, topnotch selling job.

"Identify yourself as sales headquarters. Advertise. Promote. Tell the world you're ready to sell.

"We'll be sending customers around to every appliance dealer in the area. Be sure you get your share of that business.

"Use your users! Call on the people you've already sold. A satisfied customer is the best prospect for another appliance. And she'll probably be able to give you more new leads.

And remember, time's a'wastin'. Our water heater campaign is already under way.

"Our clothes dryer campaign, gift promotion and range contest are coming up immediately.

"So that's why we're inviting you to come along with us now. Take advantage of our campaign. It's all yours. We'll do the spadework. You'll reap the harvest. We'll do the preliminary. You'll follow through. We'll do the telling. You'll do the selling."

Heating Tie-in . . .

. . . available to utilities in Gypsum Association's "Add-A-Room" promotion

Opportunity for sale of much supplementary electric heating is afforded to utilities by tie-in with the "Add-A-Room" promotion now launched by the Gypsum Association. The promotion, which will culminate in May as "Add-A-Room" month, is aimed at a potential market of 7 million home owners who, the association states, must expand their living quarters. The association will focus its efforts on the publicity phase of the promotion, with advertising and merchandising activities left to the individual manufacturers.

The utility opportunity lies in the fact that electric heating can generally be installed in room additions at less cost than that for extension of existing heating systems. And since in most cases the added room will be one not requiring continuous heat, the load will be desirable because of its high diversity factor. Detailed information on the promotion may be obtained from Theodore R. Sills & Co, 39 South La Salle St, Chicago 3, Ill, public relations counsel for the Gypsum Association.

Penelec Dryer Campaign Goes Over the Top

The offer of a "Big Deal" on electric clothes dryers paid off handsomely in sales for 520 appliance dealers and Pennsylvania Electric Co in a four week promotion recently concluded.

A goal of 1,000 sales was set, and final reports showed 1,476 dryers sold, 1,418 on Penelec lines in western and south-central Pennsylvania.

The "Big Deal," a circuit wiring allowance of up to $20, amounted to free installation for nearly all customers. The utility contributed $7.50 to the allowance, distributors paid $5 and dealers absorbed the remainder.

Penelec supported the promotion by newspaper, television, radio and display advertising, and offered a total of $1,200 in awards. Contests were held in the company's four divisions for window displays, point of sale displays and individual sales.

Resistance Goes Down . . .
Performance GOES UP
WHEN YOU DEEP GROUND
with JOSLYN

Copperweld
SECTIONAL GROUND RODS

To get low-cost, dependable grounding protection, leading engineers are using Copperweld* Sectional Ground Rods driven deep to reach the strata of better conducting soils.

Companies employing deep grounding have reduced interruptions on their overhead systems. They report fewer transformer failures and blown fuses, as well as less burnouts of meters and other equipment.

With Copperweld Sectional Ground Rods, deep grounding is simple, efficient and economical. And, only Copperweld Rods have a stiff steel core for easy driving, with a MOLTEN-WELDED copper exterior providing conductivity and protection against corrosion.

Remember, top performance and low resistance go hand-in-hand. To obtain low resistance economically, drive deep with Copperweld Sectional Ground Rods.

Let's Look At The Record

Here are a few typical results of tests, made throughout the country, showing how good grounds are obtained by deep grounding with Copperweld Sectional Ground Rods.

Location	Resistance Of First 8' Section—Ohms	Resistance Of Deep Ground—Ohms	Depth Of Deep Ground—Feet
Springfield, Mass.	3000	20	48
Petersburg, Va.	400	4	62
Tampa, Fla.	100	6	22
Youngstown, Ohio	35	6	40
Jackson, Mich.	250	6	30
Alton, Ill.	210	6	72
Brainerd, Minn.	500	5	33
New Orleans, La.	200	5	64
Corpus Christi, Tex.	400	3	24

*Trade Mark

JOSLYN

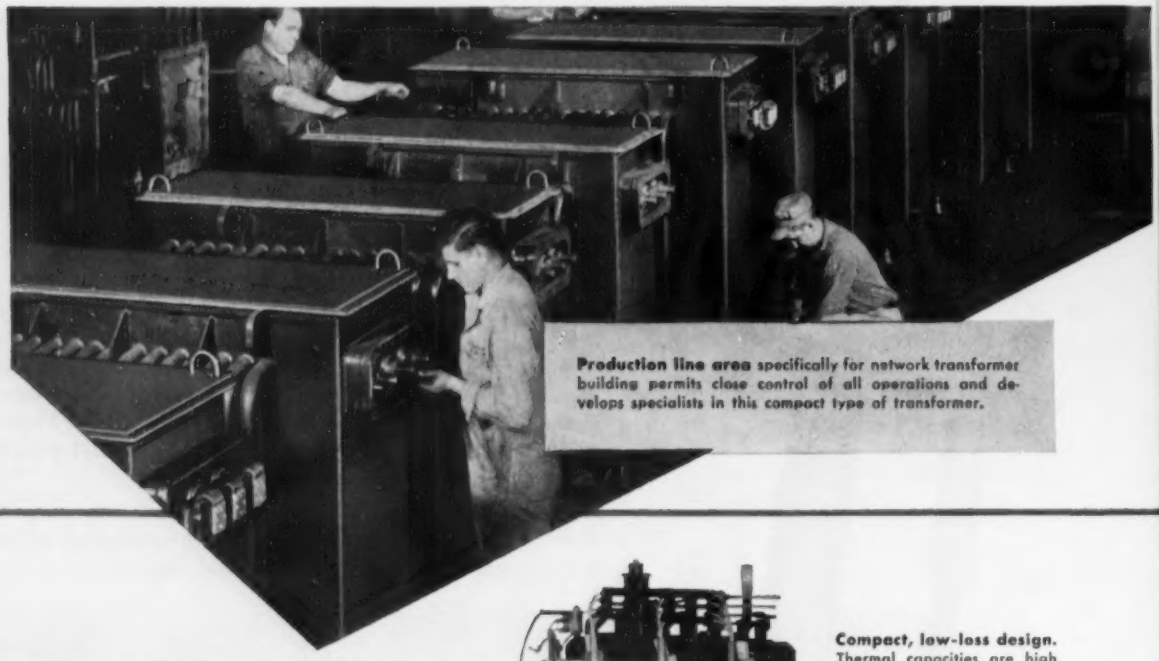
JOSLYN MFG. and SUPPLY CO.
Executive Offices: 20 N. Wacker Dr., Chicago 6, Ill.

Network Choice for

Cincinnati Gas and Electric Company has had plenty of opportunity to test the design and construction features of Allis-Chalmers network transformers. Allis-Chalmers has supplied a large part of Cincinnati's downtown network needs. Excellent operating records reflect the dependability of these units.

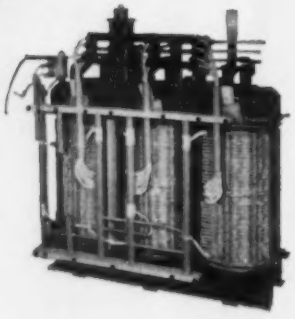
Recently two new Allis-Chalmers 1000-kva network transformers were added to the system to provide power for Cincinnati Gas and Electric's new downtown office building. These transformers are designed to meet the problem of flooding, in addition to normally rugged underground operating conditions. Thorough undercoating of tubes and surfaces in base areas with a special compound protects against extreme corrosion.

Over 1¼ million kva of these units are in operation across the country. On-the-job experience has proved their economical operation. Get more information about them by calling your nearby Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletin on Network Transformers. A-4263



Production line area specifically for network transformer building permits close control of all operations and develops specialists in this compact type of transformer.

Allis-Chalmers Design and Construction Features Prove Their Value in Operation



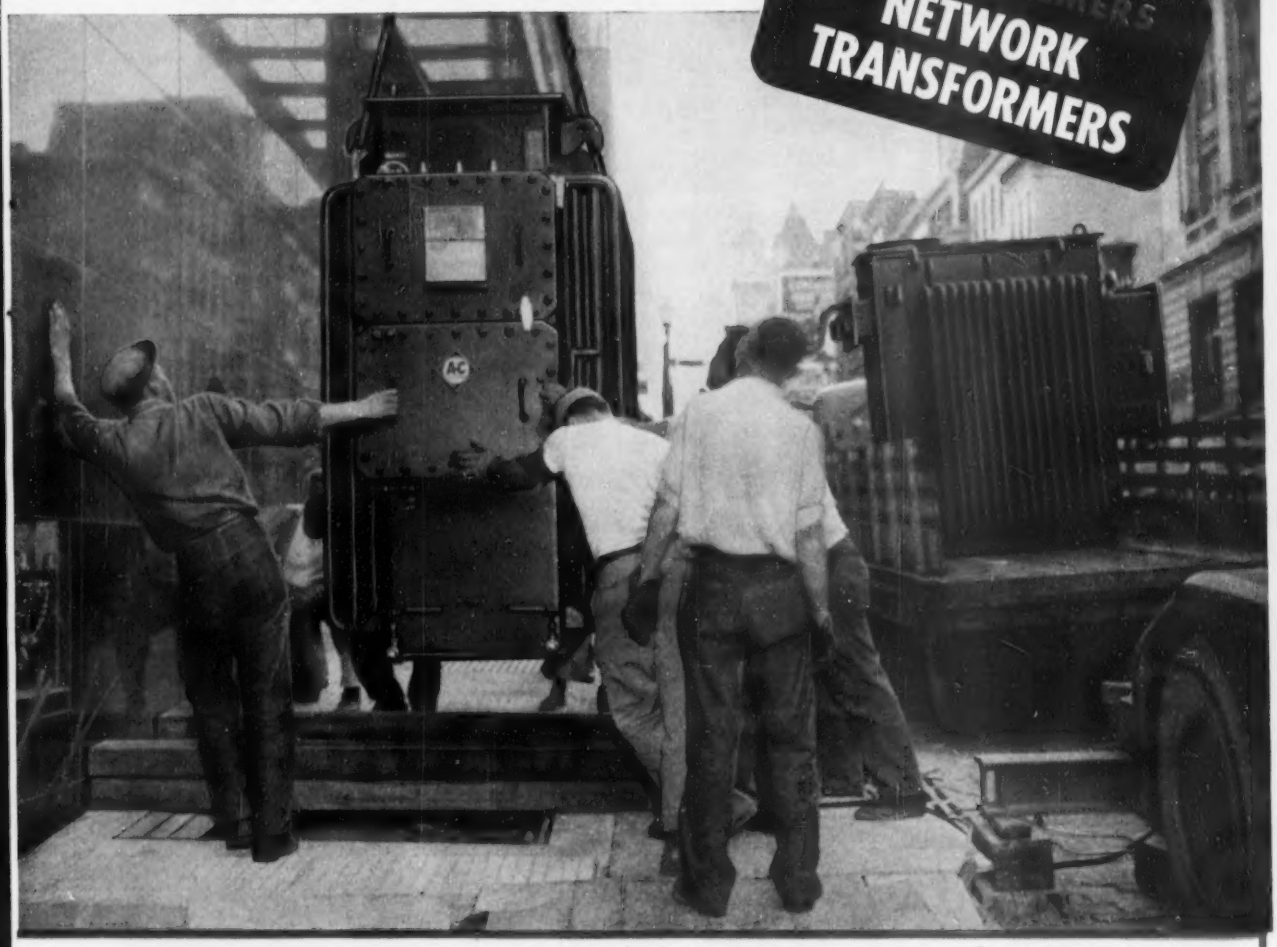
Compact, low-loss design. Thermal capacities are high even for severe load conditions. Sturdy, time-proven core and coil construction meets repeated short-circuit stresses of network operation.

ALLIS-

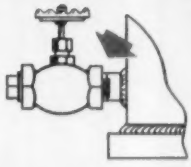
CINCINNATI

ALLIS-CHALMERS

NETWORK TRANSFORMERS



Safe, dependable no-load tap-changing mechanism. Handle inserted through two-inch opening on cover operates the tap-changing mechanism. Handle cannot be removed unless it is in positive tap position. Cover location of handle entrance eliminates packing gland maintenance.

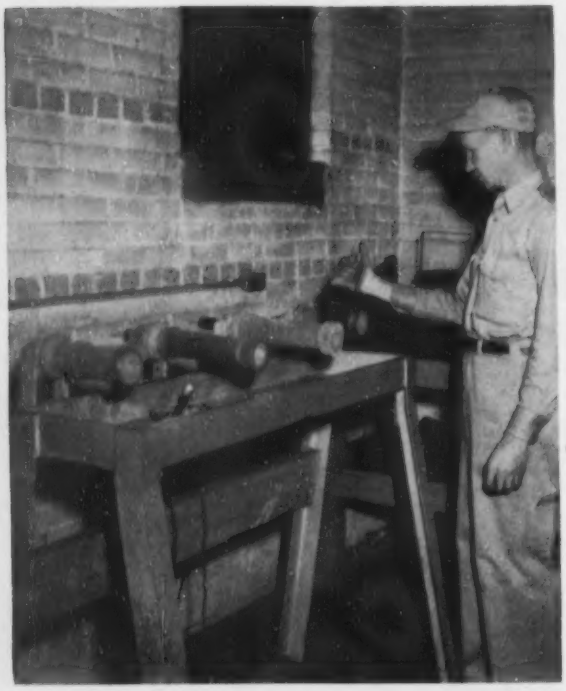


Threaded valve connections to tank are solder-wiped for extra protection. Valves are located for easy access. Globe-type valves with non-rotating seats close tight, avoid wear on valve seats.

Spiral-wound gaskets have proved their superiority over other types of gasketing material for sealing bushings in the tank wall in over 6 years' continual use. Alternate plies of preformed spring-like metal and non-metallic fillers provide unusual resilience and actually adjust themselves to changes in operating conditions. Gaskets can be installed without cements or grease. They can be quickly removed if required and may be re-used if necessary.

CHALMERS

A-C ALLIS-CHALMERS



CYLINDRICAL ELECTRIC HEATING UNITS speed removal of excess solder and metal shavings from knitting machine rings. Excess solder and metal can easily be brushed from the rings

Electric Heat Speeds Hosiery Production

JOE W. PARRIS, Advertising Dept, Georgia Power Co, Atlanta, Ga.

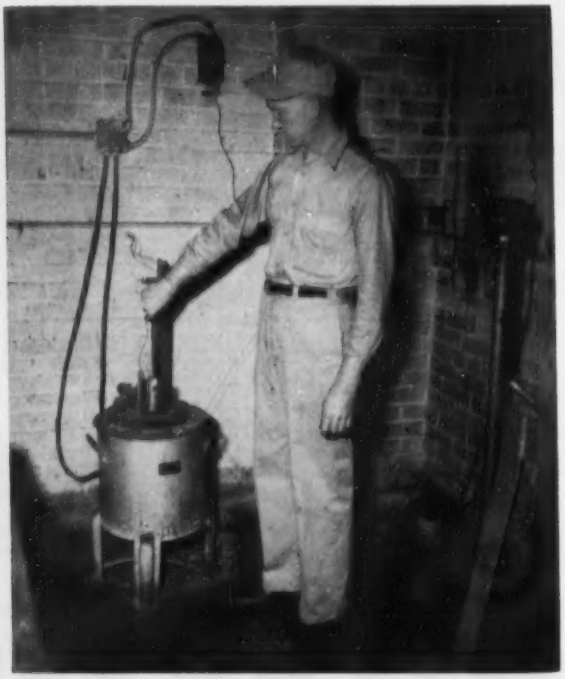
Heat treating knitting machine cylinders in an electric furnace has speeded production at Keller Machine Co, Athens, Ga. Also the use of electric heating units for removing excess solder and metal particles from knitting machine rings has saved labor and done a better job.

The 1,000-w furnace has 12 heating elements which can be used in any combination for flexibility in obtaining exact temperatures in shortest time. Peak temperature of 1600 F can be reached in 45 min compared with 2½ hr required with formerly-used gas furnaces. Also, cost of electric furnace operation is less than with the gas furnaces.

Knitting machine rings are quickly and easily processed by fitting them around cylindrical electric heating units. Excess solder and metal can easily be brushed from the rings. Old method employed slotting cutter to remove excess metal.

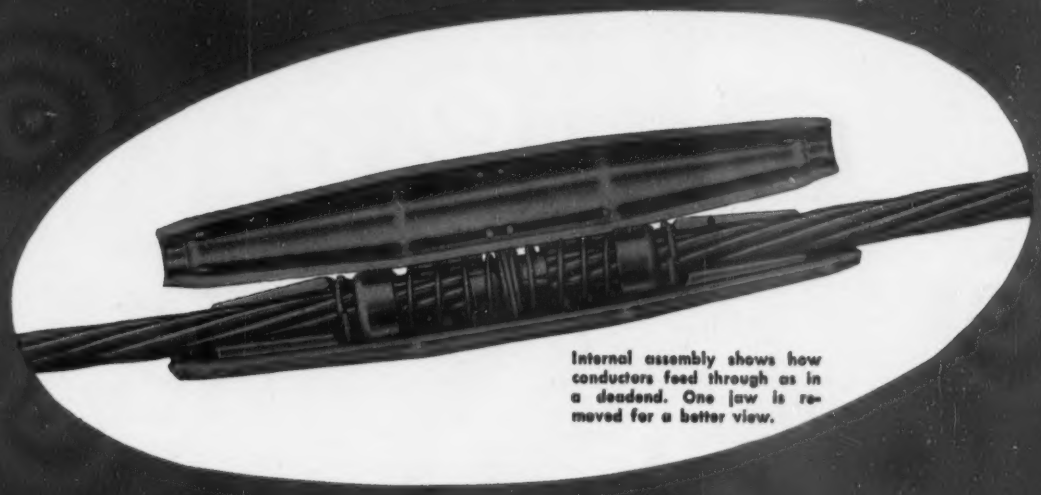
Bank of electric soldering melting pots, each having 2-1,500-w heating elements, is used to melt down metal from metal-coated machine parts.

ELECTRIC FURNACE (1-kw) heats knitting machine cylinders to about 1600 F in 45 min. Former gas-fired furnace required 2½ hr. Cost of electric operation is less than for gas-fired furnace



ELECTRIC MELTING POTS quickly remove metal coatings from metal-coated knitting machine cylinders and machine parts. Each pot has 2—1,500-w heating elements

Reliable LIFTS THE LID on a New STRAIGHTLINE Splice



Internal assembly shows how conductors feed through as in a deadend. One jaw is removed for a better view.

SPLICE OPERATES LIKE A PAIR OF BACK-TO-BACK STRAIGHT-THRU DEADENDS

The new "55" Series Straightline Splice is the surest splice yet devised for strand . . . and *still* no tools are required.

FEATURES:

1. Burred, bent, or out-of-lay strands are either properly located or are refused by pilot cups.
2. Pilot cups prevent jaws from gripping conductor until conductor is "home".
3. Complete closure prevents entry of gritty materials that can interfere with proper functioning of gripping jaws.
4. With only a straight push conductors reach "home" with a definite *feel* and *sound*.

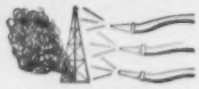
Write for new bulletin giving complete information. Reliable will gladly give you a demonstration — simply ask for it on your company letterhead.

Reliable ELECTRIC COMPANY
3148 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

what's NEW in Engineering



A triple threat fire truck to fight oil field fires is reported to have been perfected by the Seagrave Corporation of Columbus. Unlike ordinary fire-fighting apparatus, the new truck is designed to snuff out oil field and refinery fires any one of three ways; by squirting out 2800 gallons of water a minute, 1300 pounds of dry chemical compounds, or 19,000 gallons of fire-smothering "foam". In an emergency, all controls on the 20,600 pound unit can be operated by one man.

To utilize low grade ores previously stockpiled, Kaiser Engineers has designed and built a new beneficiation plant at Eagle Mountain Mine, California. The new plant will increase the iron content of the ore shipped and thus further reduce the operating costs of the West's only completely integrated steel plant, 163 miles away. Incidentally, 51 miles of this distance is over the standard gauge railroad designed by Kaiser Engineers to cross the Southern California desert and connect the mine with the tracks of the Southern Pacific.

Temperature Measurement in Engineering, described as a "how to" book for the proper design, performance, and operation of temperature measurement installation, has just been published by Wiley. The authors of the new book are H. Dean Baker, E. A. Ryder and N. H. Baker.

Kaiser Engineers has a large staff of engineering and construction experts ready to tackle your problems in all fields of design, engineering and construction. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

Tube Carrier Prevents Breakage

Fluorescent Tubes are easily transported and breakage prevented by this canvas carrier which is reinforced with metal and leather. Starters and other small parts are carried in a side pocket. A hook is used to place carrier within easy reach of man working on stepladder. E. I. Du Pont de Nemours & Co, Inc, Office Buildings Dept, Wilmington, Del.

Radiant Heat Dries Pill Coatings Faster

Radiant heaters solved the problem of drying coatings of pharmaceutical tablets at the Pitman Moore Co, Division of Allied Laboratories, Inc, Indianapolis, Ind.

Drying time of the first coating on tablets has been greatly reduced regardless of humidity conditions. The dust problem has been materially reduced. Speed of drying is more uniform. The finished tablets are drier and are not adversely affected by this type of drying. On the basis of these results five additional heaters have been installed.

An 800-w radiant heater was set at an angle in the coating pan so that heating is uniform over the tablets as the pan is rotating. The heater can be used alone or in conjunction with hot air with almost equal success.

Coatings consist of a thick white coating, a thin color coating, and a thin protective coating. Coatings are applied by placing the tablets in a rotating pan and pouring in the coating material. As the pan rotates the coating is applied evenly. Hot air is blown into the pan to dry the coating and an exhaust system is used to remove fumes and dust.

Previously on humid days it was difficult to dry the first coating even though humidity control equipment was used. As the coating dried considerable dust was formed and was blown throughout the coating room. This created a serious housekeeping problem and the speed of drying was too slow.

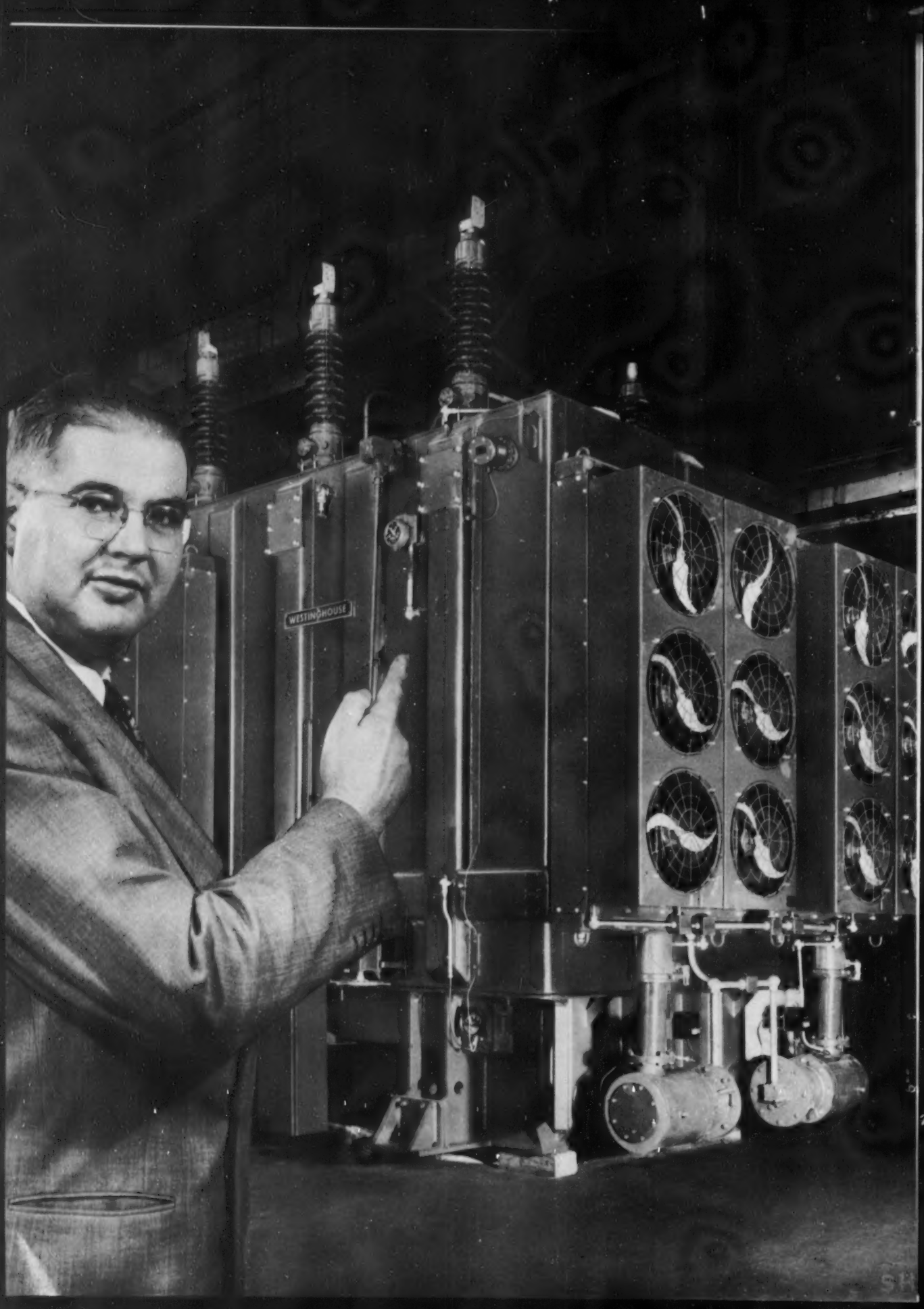
There are limitations to this application. Radiant heaters cannot be used on certain tablets due to the low melting point or volatility of certain chemicals. Since percentage output controllers were not installed, heaters cannot be used for the second and third coatings. James C. Aull, Power Sales Engineer, Indianapolis Power & Light Co.

Industrial Briefs follow on page 167

M. L. Gardner, Westinghouse Engineering and Service Manager, Northeastern Region, introduces a panel of Westinghouse engineers who will discuss ways of . . .

Reducing your system operating headaches

To many utility people, Matt Gardner is "Mr. Westinghouse." In 30 years of distinguished service, he has been associated with practically every phase of electric utility engineering—research, development, application, service. On the following eleven pages, Matt and other top Westinghouse engineers will show you how quality-engineered equipment can solve or simplify system operating problems.


WESTINGHOUSE

"John Rissinger, Manager of Power Transformer Sales, points out how . . ."

TRO and SP relays minimize transformer operating problems

The TRO relay which for years has enabled you to load your transformers to the limit of their thermal capability is now equipped with a dial calibrated in percent thermal load. This gives your operator direct visual evidence of the thermal condition of your unit, based, as in the past, on a combination of transformer load, oil temperature, ambient temperature and prior load conditions. Three contacts are retained and may be used to control auxiliary cooling, light warning lamps or trip a breaker.

The SP relay provides the operator with the long-sought answer to the problem of detecting transformer faults before extensive damage results.

Mounted on the side of the tank opposite the gas space, the new relay is designed for alarm-trip circuit closing on the occurrence of an internal fault producing an abnormal pressure rise. It will detect rates of change even smaller than two ounces per square inch per second. For steep-front increases of 40 pounds per square inch per second, it will operate in ½ cycle.

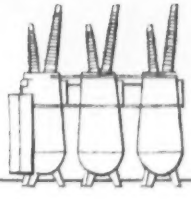
Disturbances such as inrush current, short circuits, impulse voltages or mechanical shock will not actuate the relay.

With these and many other equally important design features, you can be sure that Westinghouse power transformers will reduce your operating and maintenance headaches.

TRO thermal relay

Sudden pressure relay

The next page shows how Westinghouse breaker mechanisms solve a problem for you, too.

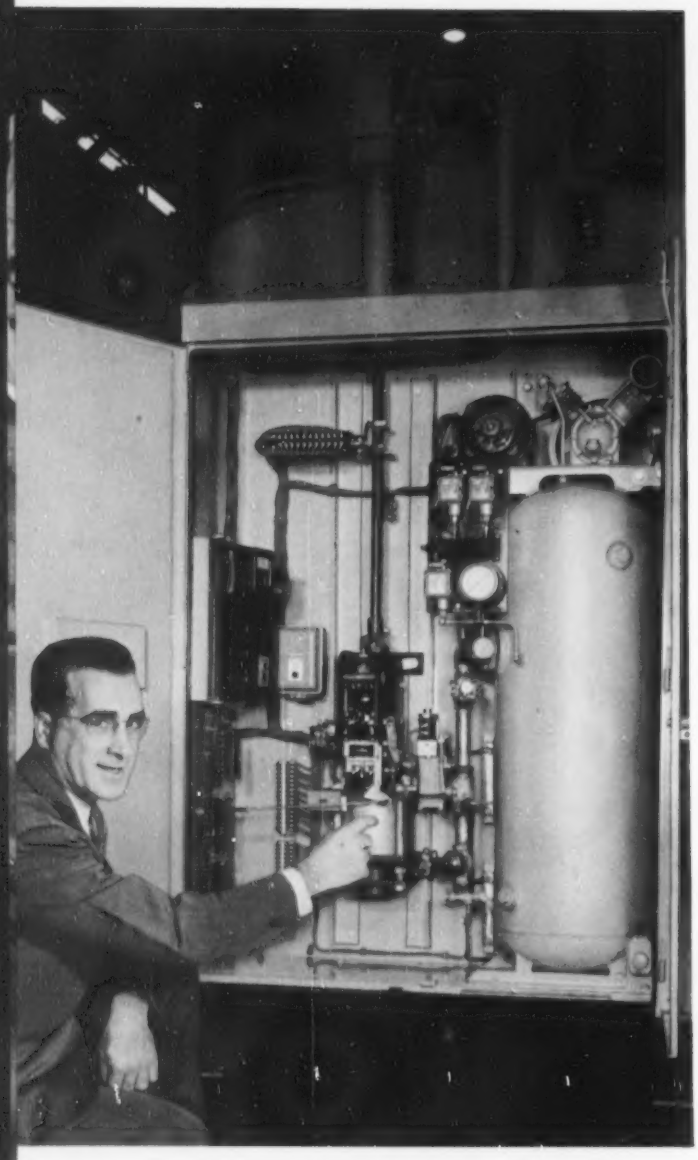


YOU CAN BE **SURE**... IF IT'S

Westinghouse

"Here's Jack Stirling, Power Circuit Breaker Sales Manager, with the answer to the problem of operating high-voltage circuit breakers."

Pneumatic mechanisms offer high-speed, trip-free operation . . .



Today's high-voltage, high-capacity breakers require not only a powerful closing mechanism, but one that is mechanically trip-free for fast action under any conditions—3-cycle opening, 15 to 20-cycle reclosing. And yet one that is simple, accessible and easy to maintain.

The Westinghouse Type AA mechanisms are daily meeting these basic needs—powerfully closing the largest breakers, even on faulted lines—opening mechanically trip-free, without delays—reclosing in the shortest time.

Mechanically trip-free operation insures unretarded, high-speed opening of the breaker even when closed in on a fault. A pneumatic trip selector, however, provides for ultra-high-speed reclosing. Tripping "non-trip-free" only when no compressed air is in the cylinder, the contact travel is smoothly reversed before the end of the opening stroke by the early admission of compressed air into the cylinder. This, first, cushions the opening and, second, recloses without the contacts or breaker parts moving at excessive speeds. There is no shock or hammering of oppositely moving parts, since the piston and contacts are tied together and move in the same direction during the complete operation.

Westinghouse pneumatic mechanisms utilize low air pressure with time-proven pressure accessories.

Corrosion-resisting metals are used throughout, and exclusive roller bearing latches—*not* custom fitted—require no field adjustment for life.

These outstanding mechanisms are available on the complete range of Westinghouse oil circuit breakers from 14.4 kv, 500,000 kva through 330 kv, 25,000,000 kva.

YOU CAN BE **SURE**...IF IT'S

"Al Cleveland of Voltage Regulator Sales points out two good reasons why Westinghouse induction voltage regulators help reduce your operating headaches."

No "contact bounce" frees this regulator from contact wear

When you compare the operating and maintenance characteristics of voltage regulators—almost everyone agrees on the superiority of an induction regulator in those applications requiring high frequency of operation.

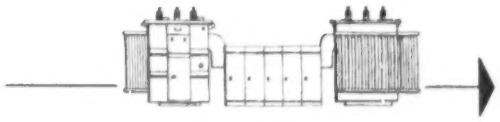
The new Westinghouse Type SU improves on the average induction regulator by an exclusive "no bounce" contact design common to its motor-operating and voltage-regulating relays. No bouncing means no arcing—no contact wear.

The design, through a spring hinge, eliminates all bearings and pivot points. In a recent laboratory test, over 100 million operations (more operations than 200 years of typical field service) failed to produce hinge fatigue or contact wear. The original calibration remained unchanged.

In addition, the all-electric control panel on the SU regulator simplifies operation. All adjustments are made by simply turning the knobs on the convenient control panel. No tools are necessary.

On an application requiring frequent voltage corrections, you can't beat a Westinghouse Type SU induction regulator for fast, smooth operation—at greatly reduced maintenance.

For substantial evidence that Westinghouse unit substations are unmatched in the industry, turn the page.



Westinghouse

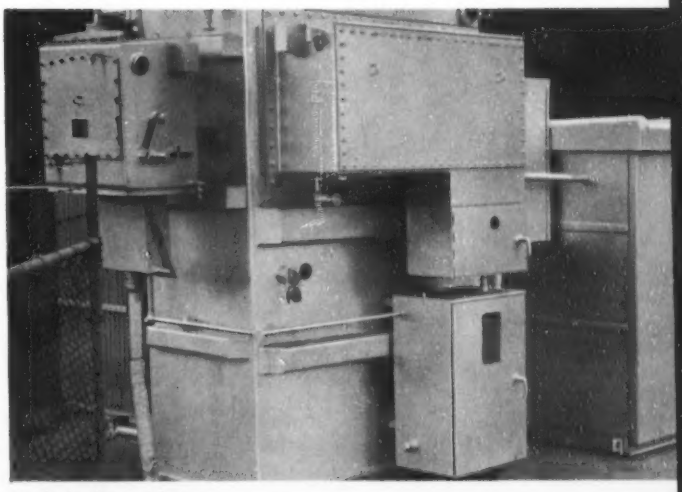
"Here's Wally Payne with some specific reasons why his unit substations can reduce operating problems."*

Westinghouse unit substations simplify station conversion . . . operation . . . maintenance

Today, many utilities reduce the magnitude of their system operating problems by dividing areas into smaller blocks of power. They report that unit substations make the conversion easy, as well as simplifying station maintenance. Too, compactness and flexibility reduce both cost and effort of keeping pace with load shifts.

But even more, advantages of Westinghouse unit substations go several steps further to relieve operating headaches. For example:

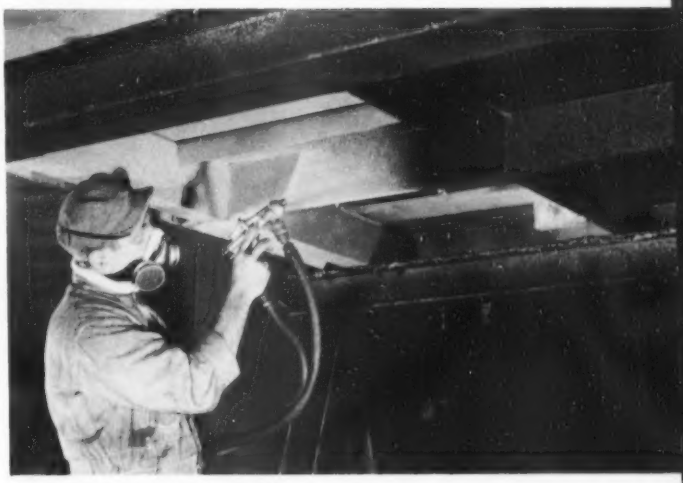
The transformer-mounted, underload tap changer, with its direct connected mechanical drive, eliminates springs, latches and shock absorbing devices, thus achieving a positive, reliable, quiet drive having a small number of parts with resulting low maintenance.



Underload tap changer

Drawout "De-ion®" air breakers operate on an exclusive arc-quenching principle that lengthens contact life, reduces maintenance. The drawout feature makes quick inspection easy, completely safe.

All-weather undercoating of all compartments—not just the transformer—provides extra weather protection as a standard feature.



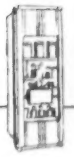
All compartments undercoated

Unit responsibility. Westinghouse unit substations have *all* components engineered and coordinated by one manufacturer with complete control of design, manufacturing and assembly. Westinghouse components are built . . . not adapted . . . for their ultimate job.

Westinghouse has long been a designer and manufacturer of a complete line of power distribution apparatus for any system requirement. The men and organization to make this experience available to you are as near as your telephone. They're ready and anxious to serve.

**Manager of Unit Equipment Sales.*

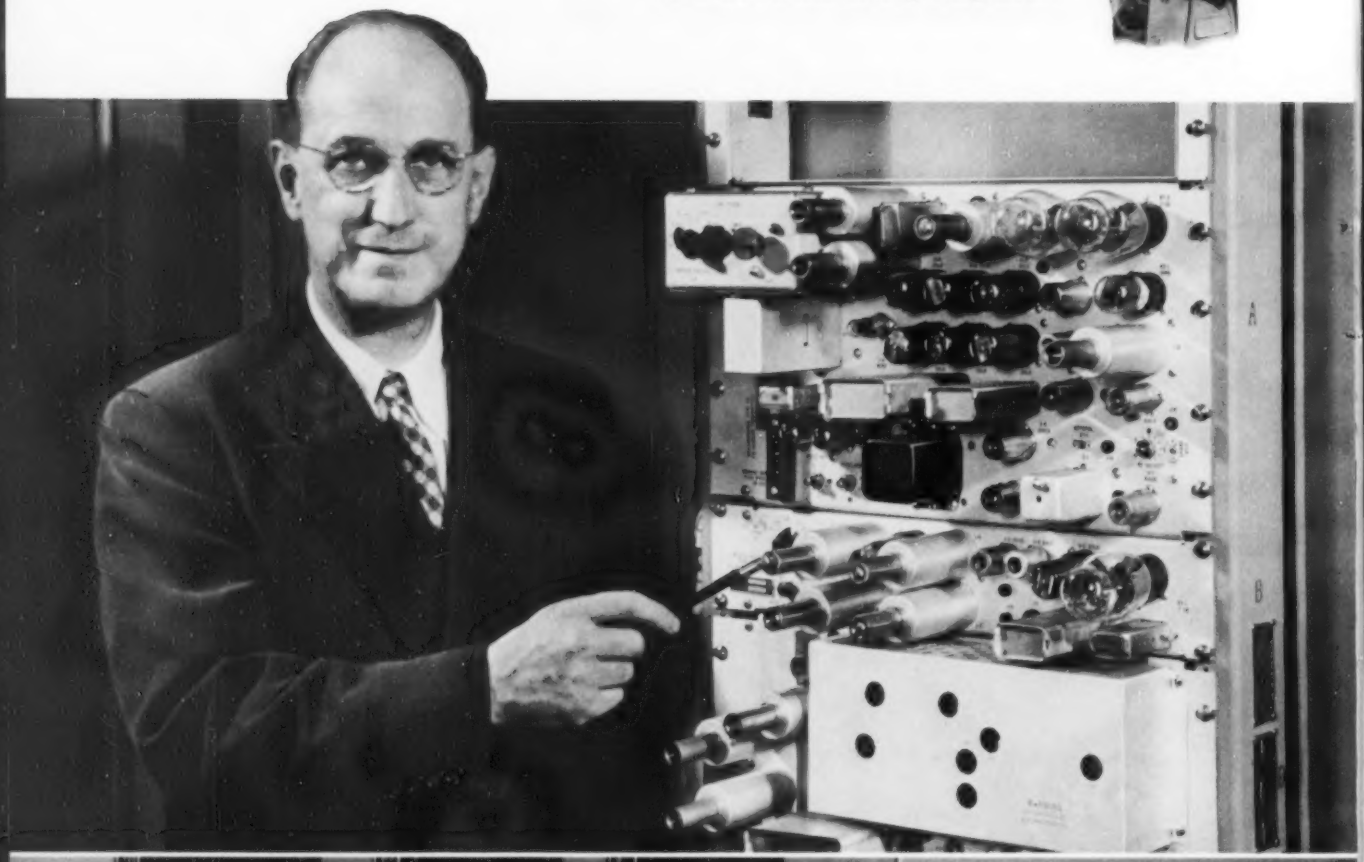
The next pages show how a versatile relay avoids unnecessary trip-out.



YOU CAN BE **SURE**... IF IT'S

Westinghouse

"Power line carrier equipment and relays work hand in hand to give you system stability," say Jim Booth, Carrier Engineer and Bill Rich, Relay Engineer."



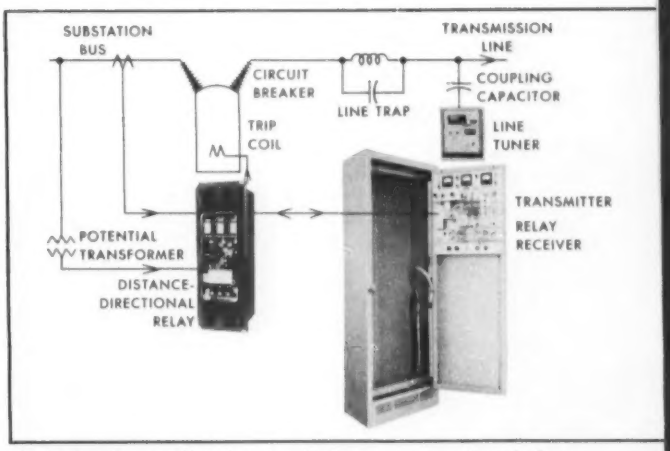
Smooth coordination of Westinghouse relays and carrier minimizes line disturbances

For full protection of key high-voltage transmission lines, it is good business to specify Westinghouse Type HZM relays and Type FD power line carrier as the relaying channel. Working together, this equipment permits simultaneous tripping and reclosing—over 100% of each protected line section —without time delay.

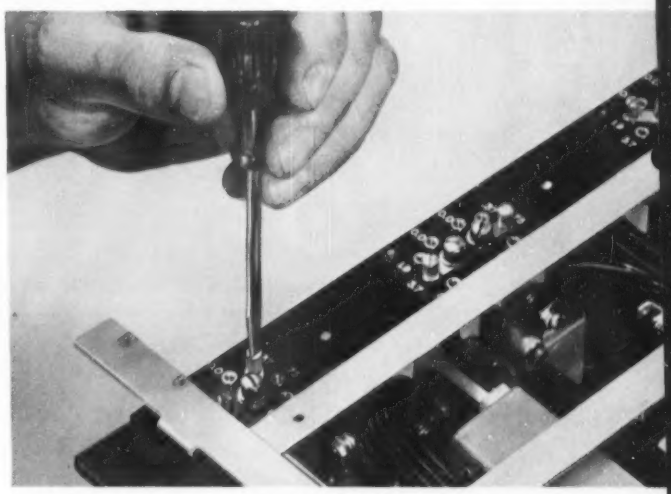
HZM relays alone provide instantaneous protection for 80 to 90% of the line section. Type FD carrier extends this protection to critical end zones for complete coverage. HZM relays and FD carrier are carefully coordinated to operate together smoothly, efficiently.

Type FD carrier is new, and has many outstanding features. Superselective receivers, for instance, provide more usable channels within the 40 to 200-kilocycle frequency range. Built-in automatic current regulators—used in carrier for the first time—assure maximum tube life and reliability. FD carrier operates through circuits having as much as 40 decibels attenuation, affording a large safety factor for changing line conditions. A new, wide-range sleet detector checks the entire carrier channel including vacuum tubes and other carrier components. FD carrier is also available in assemblies for telemetering, supervisory control, voice communications and other functions.

The HZM relay is extremely fast acting—operating in less than three cycles. Fundamentally, impedance relays do not operate on loads or synchronizing surges, even though they may be greater than fault currents that *do* trip the relay. In the HZM relay, this feature is extended even further by offsetting the operating characteristics of any or all of the three impedance elements, as required. Westinghouse also makes the HZ-4 relay in which only the third element can be offset.



A basic distance-directional relaying system, using indoor-mounted Westinghouse Type FD carrier and Type HZM relays.

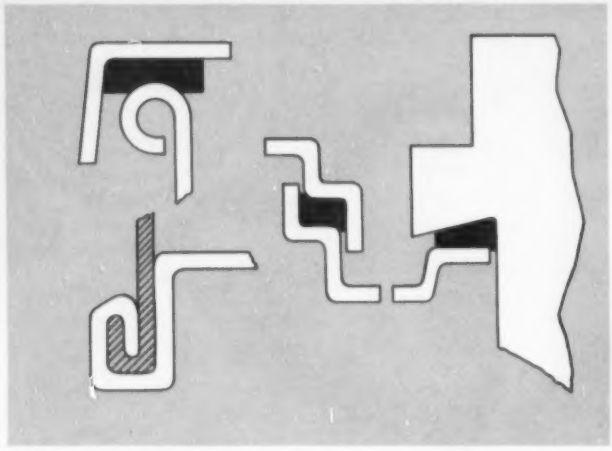


The network for offsetting the impedance circle of the HZM relay is now built in—no auxiliary box is required.

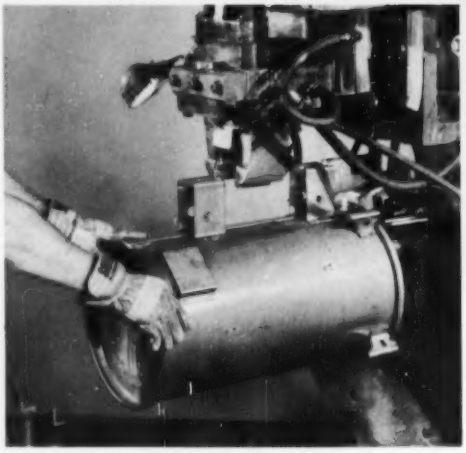
You'll see how special construction solves transformer operating problems on the next page.

YOU CAN BE **SURE**...IF IT'S

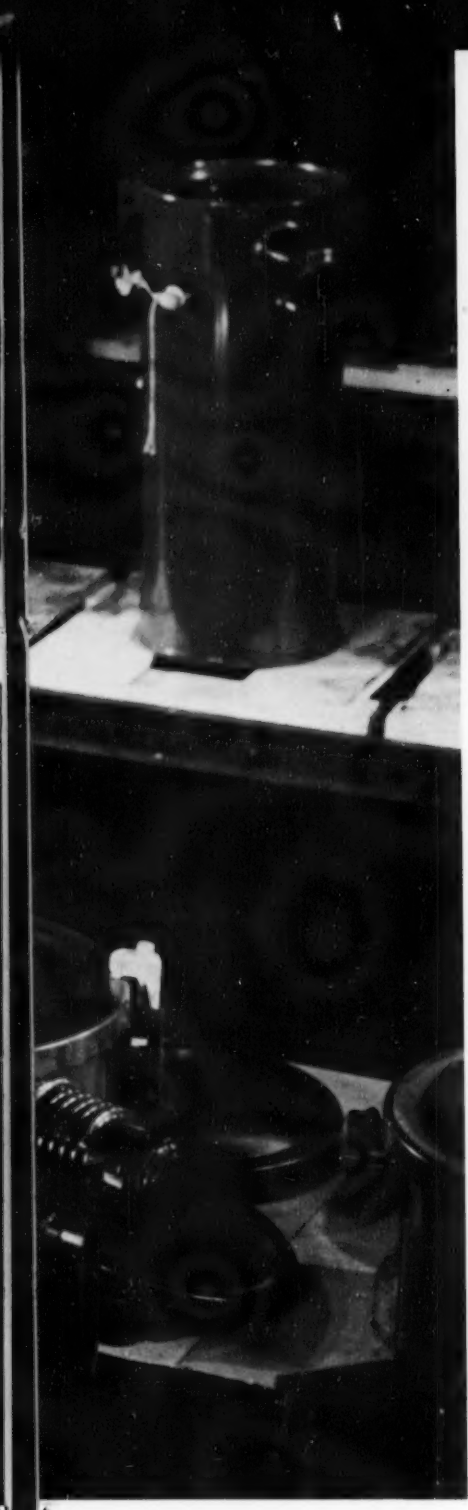
Westinghouse



Double-rolled tank bottom assures positive oil-tight seal and protection against damage in handling. Main and handhole covers are sealed by cork-neoprene gaskets, firmly positioned to assure tightest possible seal.



Hanger lugs, nameplate bracket, lifting lugs and other accessories are projection welded to the tank wall. The security of all welded joints is tested by air pressure at 20 pounds per square inch.



"W. L. McKeithan, Section Manager, Distribution Transformer Engineering, discusses a transformer feature that plays an important part in eliminating operating headaches."

This triple-sealed distribution transformer design eliminates possible trouble

All Westinghouse distribution transformer tanks are made of highest quality steel with positive seals—at the tank bottom—at the cover—and at all accessory locations.

Exclusive rolled tank bottoms have oil-tight, double-rolled rims. Since the design prohibits the transformer weight from ever stressing the seal, the transformer can be stored, moved, loaded or installed without the extra care required by common designs.

Covers, handhole and bushings are sealed with cork-neoprene gaskets. Cork-neoprene is impervious to oil, moisture and corrosive elements—will not take a permanent set—is not subject to aging, stress cracking and has no seam. It assures a positive seal for the life of the transformer.

Hanger lugs, nameplate bracket, lifting lugs and other accessories are projection welded to the tank wall. The security of all joints is tested by air pressure at 20 pounds per square inch.

Triple-sealed tank construction is just one of the several features of Westinghouse distribution transformers that add up to less operating headaches at a vital point in your distribution system. It will pay you to investigate further.

How to get optimum performance from all of this equipment is discussed on the next page.

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Westinghouse field engineers lick operating problems before they start. M. L. Gardner, Engineering and Service Manager, Northeastern Region, cites a typical case:

How Westinghouse helped the Astoria Station get off to a fast, smooth start

"It takes time and teamwork to get a new generating station like Consolidated Edison's Astoria on the line and running smoothly.

"Under my supervision, Joe Greenbaum—the Westinghouse field engineer assigned to Con Ed—lived with this job right from ground breaking. Westinghouse supplied four 100,000-kva generator transformers, station auxiliary switchgear, main control board and powerhouse auxiliary motors. We were there to help supervise erection, installation, connection and check-out of Westinghouse apparatus. We worked closely with Con Ed engineers to tie all equipment together into a smoothly functioning operation.

"We were all pleased when Astoria went on the line and, what's more, we'll help keep it that way by frequent inspection and servicing of all Westinghouse equipment."

* * *

M. L. Gardner's story proves this point: the best performance results only when quality apparatus is matched with quality field engineering service.

Over 1200 Westinghouse district engineering and service men make sure that *you get the performance you buy* in every piece of Westinghouse apparatus. It's a service that frequently makes the difference between Westinghouse and other equipment, *all the difference in the world!*

For further details, go over this check list with your local Westinghouse representative . . . or we'll gladly mail specific data on written request to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Distribution Transformers	DB 46-1005	Carrier-Microwave	B-5873
Power Transformers	B-4142A	Relays	DB 41-412
Power Breakers	DB 33-125 and B-5904	Unit Substations	B-4061, B-5306, DB 47-410

YOU CAN BE SURE...IF IT'S

Westinghouse

CP-1014

INDUSTRIAL BRIEFS

Fusing glass fibres to a vinyl base is speeded at Hess, Goldsmith & Co, Inc, textile plant, Wilkes-Barre, Pa., by electric radiant heaters in drying oven. Problem was to remove about 3% moisture from the material. Heaters, having 54-in. heated length, are mounted to permit their being moved away from the web or rotated 90 deg to prevent residual heat from overheating material in case of machine stoppage. Mounting positions are on 8-in. centers, 3 in. from the web. Output of heaters is controlled by input controller and magnetic contactor, depending on web speed and material processed. Harold Bryson, Industrial Power Representative, Pennsylvania Power & Light Co.

Producing steel in electric arc furnace at Atlantic Steel Co, Atlanta, Ga., cuts cost of ingots $3.00 or more per ton compared with same grade steel ingots by open hearth furnace. Advantages of electric furnace over open hearth are: greater availability for charging (94% vs 88%); more speed in making steel (76-ton electric furnace heat can be tapped every 5 hr compared with 80-ton heat every 9½ hr with open hearth); refactory material cost only one-third that of open hearth and higher quality steel is produced with electric furnace. The electric furnace uses 100% scrap, while open hearth requires 25% pig and 75% scrap per charge. In spite of scrap contamination, electric furnace yields 4% more steel out of material than does open hearth, which loses some of its steel in slag. Electric furnace has 16,000-kva maximum load in ½-hr period and consumption of about 5 million kwhr per month.

Heating dies for ladle bricks with 650-w cast-in heating elements at Brighton Brick Co, New Brighton, Pa. prevents clay adhering to dies. Cast-in heaters simplify wiring and provide more free space for operator in front of machine. Brick is processed on dry presses where clay is controlled to 7% moisture content, then placed between two dies at 2,000 lb per sq ft pressure. At this pressure the clay would adhere to dies if left at room temperature. J. B. White, Jr, Supervisor, Industrial Sales Dept, Duquesne Light Co, Pittsburgh, Pa.

ELECTRONIC TELEPHONE LICKS NOISE!

MODEL NO. 100

*The GAI-PHONE

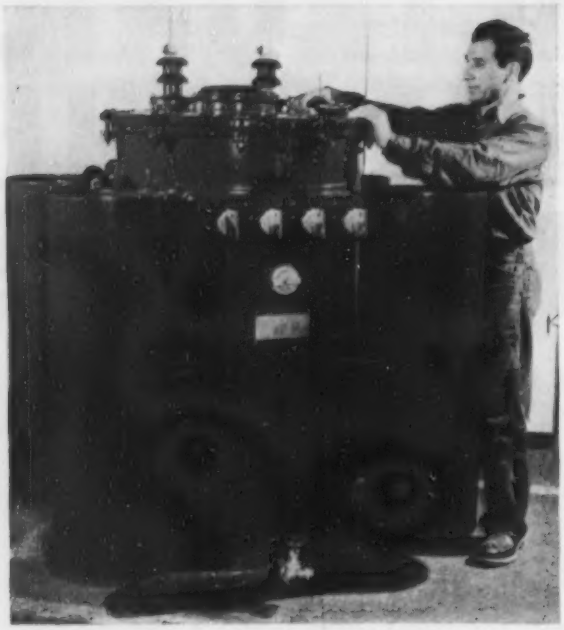
MAKES COMMUNICATION POSSIBLE IN EXTREMELY NOISY AREAS.

- NO BOOTH REQUIRED.
- SURPRISINGLY LOW COST.
- PROVED PERFORMANCE.
- RUGGED LONG-LIFE CONSTRUCTION.
- OPERATES AS CONVENTIONAL TELEPHONE.
- EASILY INSTALLED IN EXISTING TELEPHONE CIRCUITS.

GAI-TRONICS CORPORATION
A SUBSIDIARY OF GILBERT ASSOCIATES, INC., ENGINEERS AND CONSULTANTS
READING, PA.

FREE BOOKLET
WRITE · GAI-TRONICS CORPORATION DEPT. P, READING, PENNA.

NEW EQUIPMENT

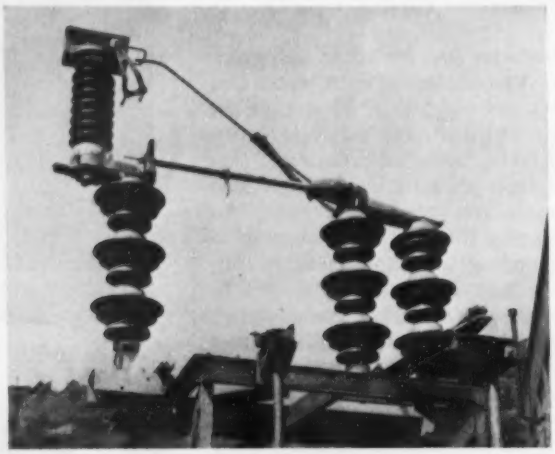


Station Transformer

A new substation-size transformer has chimney-type radiators instead of numerous tubes. Radiators are said to permit a 6% reduction in weight and 30% reduction in height without any sacrifice in electrical characteristics. In addition, the transformer is easier to paint, and strength and tightness of the tank are improved because of fewer openings, it is claimed.

Transformers with the new radiators are available in ratings of 250 kva at 15 kv and below. Other ratings will be added in the future.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.



Interrupter Switch

A new load interrupter switch, Type VLB, consists of a standard disconnecting switch, Type V, to which is added a gas-filled load-interrupting device. The switch is said to interrupt transformer magnetizing currents, line charging currents, and load currents up to its continuous rating.

The gas-filled interrupter is a parallel-connected unit which carries current only during the interrupting interval. It is porcelain-clad, gas-sealed, and requires no external gas supply or auxiliary apparatus for operation. Sulfur-hexafloride gas provides an effective interrupting medium, yet is not consumed and does not deteriorate appreciably during circuit interruption, it is claimed.

The switch is available in voltages from 7.5 to 115 kv, at currents of 400 and 600 amp.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Photo Switch

A photoelectric light switch, called Lumatrol, is said to have a sensitivity to light of more than 0.5 cp. The switch has a time delay circuit to provide two min lag between exposure to light and actuation.

Switch is encased in a weatherproof translucent case to provide sensitivity from all directions. Connections are said to be simplified by the external male plug that plugs into a receptacle.

Micro Balancing, Inc, Herricks Rd, Garden City Park, N. Y.

Disconnect

A new two insulator, side-break, disconnecting switch with one insulator rotating for operation is adaptable for manual control, high-speed spring, or motor operator. Its mechanical action employs a minimum of moving parts, exerts high contact pressure, and is dependable under any speed of operation, it is claimed.

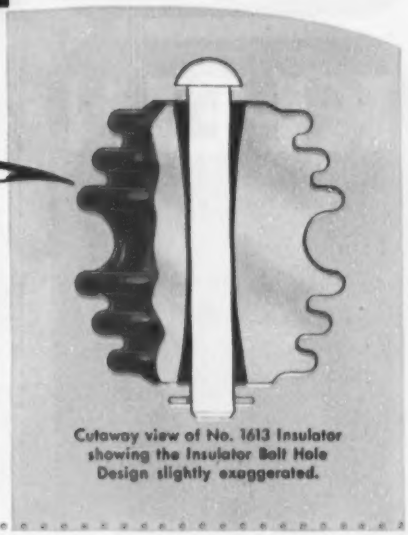
Controls and switch parts are designed so that ice formation is in shear. Leverages are said to assure operation under icing conditions. The rotating insulator is supported by a

Better DESIGN

Gives Greater Strength

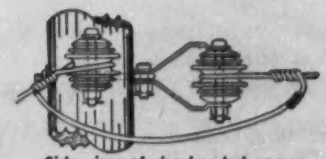
No. 1330

No. 1344

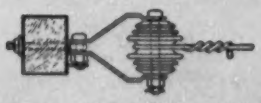


Cutaway view of No. 1613 Insulator showing the Insulator Bolt Hole Design slightly exaggerated.

Installation of two No. 1330 on eye bolt and eye nut



Side view of dead-ended corner installation of two No. 1330



Typical cross arm installation of No. 1330

No. 1344 and No. 1330 installed on opposite ends of eye bolt

A mechanical feature of these Hubbard Clevises, not generally known, is the design of the bolt hole in the insulator, known as the "double tapered hole" as illustrated by the cut-away view above. Its purpose is to develop maximum strength in the porcelain. Most insulator failures, under heavy line load, start at the outer ends of the hole. This is due to the slight "bowing" of the bolt under loading, which results in concentrated "high point" pressures on the porcelain at the ends of the hole.

The "tapered" design, on the contrary, transfers the strain from the ends of the hole to the center portion of the insulator during the first stages of the loading. The center portion is stronger and presents a larger area, resulting in a lowered pressure. As the loading is increased, the bowing of the insulator bolt continues until it conforms to the taper of the hole, at which stage maximum resistance to the load is offered.

It is this design which has established these Hubbard Clevises as the high strength, quality products which they have been down through the years.

Electrically and mechanically . . . they are better.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

When Life's at Stake Rely on...

KLEIN

Show the familiar Klein trademark to the old-timer on the pole and he'll tell you—"that's the equipment I've been using ever since I was a grunt."

Yes, workmen just naturally feel safer when the equipment is Klein—recognized for quality "Since 1857."

ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York.

Write for your free copy of the Klein Pocket Tool Guide today!

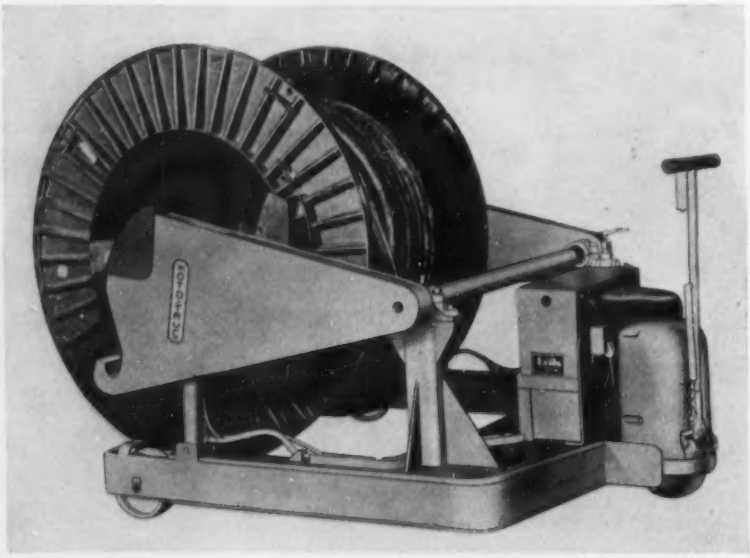
Since 1857

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVE. CHICAGO 18, ILL.

double-race, non-corrosive, ball bearing designed for dry operation.

Type 57-K meets NEMA Standards and is available in voltages of 7.5 to 69 kv with currents of 400, 600, and 1,200 amp.

Southern States Equipment Corp, Hampton, Ga.



Reel Truck

A new reel handling truck has an electric hydraulic lift with a capacity of 16,000 lb and a maximum lift of 14 in. It will handle reels up to 84 in. in diam, travel at speeds of 2½ to 3 mph, and has two speeds for forward and backward movement.

Powered by an 18-v battery, the power unit has roller-grip controls and a push-button hydraulic lift system. "Dead man" controls are standard, with automotive-type brake applied to the drive wheel. Walkie-type design affords minimum turning radius.

Moto-Truck Co, 1929 E. 59th St, Cleveland 3, Ohio

Magnet Wire

A new silcone enameled magnet wire is intended for use in electrical equipment operating at a hot-spot temperature of 130C. It is said to have good abrasion resistance, adheres well to the conductor, is smooth and tough, and is not attacked by common solvents. The fill is removed by chemical strippers or by using coarse wire brushes.

Dielectric strength of the enamel is 1,500 volts per mil. Best results in winding will be obtained by using silicone treated fiberglass insulators and silicone varnishes. Wires insulated with the enamel is furnished in single and heavy grades.

Anaconda Wire & Cable Co, Muskegon, Mich.

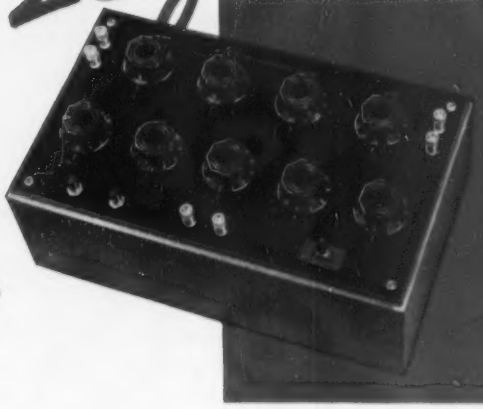
New Motor Design

A completely new motor, designated as Uniclosed, Type H, and designed to NEMA specifications is available. Frame is solid, one-piece cast iron and stator is pre-wound. Available in frame sizes 182-184, it offers splash-proof protection through its completely splashproof design. Built more compactly, the motor provides the same horsepower in less space. End brackets of new design have air intakes arranged to prevent intrusion of water, yet allow liberal air flow for two-way ventilation.

In its various sizes the new motor meets the same standards as former type in temperature rise, torque.

U. S. Electrical Motors, Inc, Box 2058 Los Angeles 54, Cal.

"We have used D-H MANGANIN for 25 years..."



DOUBLE-PURPOSE BRIDGE. This Shallcross Model 6320 Wheatstone Limit Bridge can be used both for exact resistance readings and, in production, for rapid checks on percent deviation from an accepted standard. Overall range extends from 0.1 ohms to 111,110,000 ohms. All resistors are D-H Manganin.

Says **SHALLCROSS MANUFACTURING COMPANY,** Collingdale, Pa.: "For 25 years we have been using Driver-Harris Manganin wire in the construction of Wheatstone and other precision bridges. In addition, D-H Manganin alloy has been used in many special standards for research and development laboratories. We feel that the quality of our products and the reputation of our instruments have been greatly enhanced by its use."

Behind statements like these stand Driver-Harris production and drawing techniques, which provide Manganin of such fixed stability that maximum change in resistance between 15°C and 35°C is only about 15 parts per million per degree centigrade—and frequently *less than one-third this* amount. Equally good electrical characteristics are available for ammeter shunt stock operating between 40°C and 60°C.

The experience of Shallcross reflects the experience of a host of manufacturers throughout the country; reflects what *you* can expect from Driver-Harris products, whether Manganin or any of the numerous alloys developed by Driver-Harris for application in the electrical and electronic fields.

Whatever your alloy problem, therefore, let us have your specifications. We'll gladly put at your disposal the skills acquired from 50 years of alloy manufacturing experience . . . make recommendations based on your specific needs.

*T. M. Reg. U. S. Pat. Off.

Sole producers of world-famous Nichrome*

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

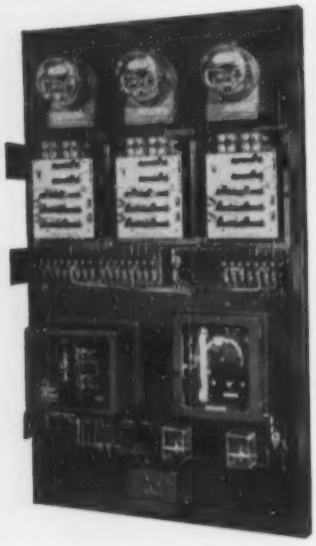
In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

Transformer Loss Compensator

Saves you Money!

SPECIAL FEATURE: It saves you money because it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the transformer.



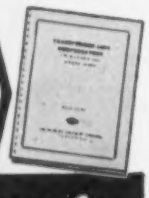
THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced with two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

Get your book now FREE

Detailed information on operation, installation, applications. Write for Bulletin NO. 63-A.



EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

Backfiller

A new backfilling machine, Model 190, has a 7-ft, 1,000-lb backfill board suspended from a boom. The adjustable boom can be telescoped from 19 to 27 ft and can be easily removed. As a side crane the 190 has a 50,000-ft-lb capacity figured from the edge of the crawler, 10,000 lb five ft out, and 5,000 lb 10 ft out.

Four separate transmission-controlled line speeds are available for both pull-in and throw-out cables, ranging from 47 to 450 fpm. Crawler speeds from 1 fpm to 4.3 mph in either direction are provided. The Diesel-engine power plant develops 79 hp at 1,400 rpm. Ground bearing pressure on the crawlers is 6.2 psi.

Cleveland Trencher Co, 20100 St. Clair Ave, Cleveland 17, Ohio

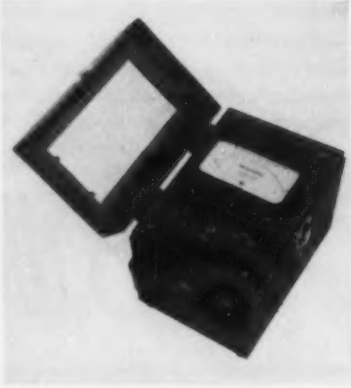
Circuit Breaker

A new "E" frame circuit breaker has enlarged pole spacings, solderless pressure-type terminals, and quick-make, quick-break contact action. Thermal-magnetic tripping protects against overloads and short circuits. On manual or automatic operation, common trip feature opens all contacts simultaneously. Trip-free handle mechanism prevents breaker from being closed against faults.

Breakers are available in ratings from 15 to 100 amp; 1 pole: 125 v ac and dc; 2 and 3 pole: 250 v ac and 125/250 v dc; 5,000 amp interrupting.

I-T-E Circuit Breaker Co, 19th & Hamilton Sts, Philadelphia 30, Pa.

Insulation Tester



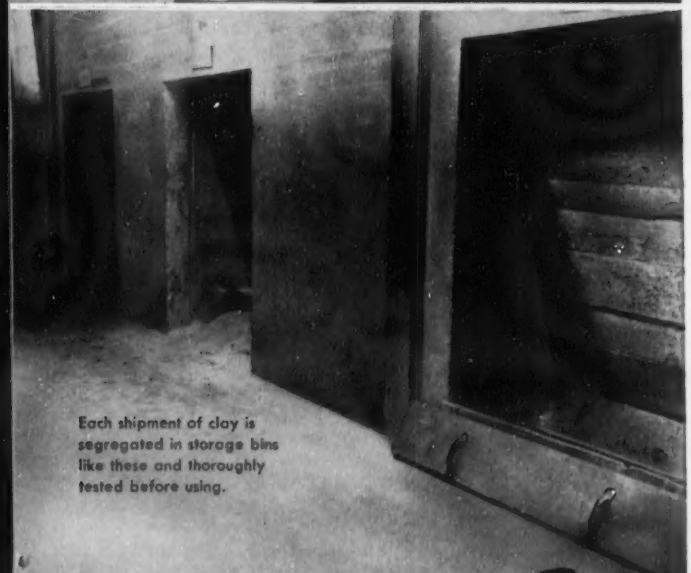
A portable, dry-cell operated, insulation resistance tester is said to provide essentially constant dc test voltage independent of ohmic value being measured. The circuit is designed around a synchronous vibrator power supply with maximum output current of 400 microamperes at 500 v dc. Megohm ranges are 1-100 and 1-1,000.

Instrument is housed in a steel case with removable cover and measures 8⅞ x 6 x 8¼ in. Weight is 18 lb.

Associated Research, Inc, 3758 W. Belmont Ave, Chicago 18, Ill.

The world's finest ceramic raw materials come from the states shown in color. Victor uses them exclusively.

Power trucks with special scoops unload clay from cars.



Each shipment of clay is segregated in storage bins like these and thoroughly tested before using.

Specify **VICTOR**

PURIFIED PORCELAIN

INSULATORS

Another Reason Why—

VICTOR Makes Better Insulators

WE USE AMERICAN CLAY, FLINT AND FELDSPAR EXCLUSIVELY!

BETTER INSULATORS begin with better materials. Victor was the *first* to recognize the superior qualities of *American* clays and the advantages of closer control over sources of supply. That's why Victor *Purified* Porcelain insulators have greatest uniformity in mechanical and electrical strength values. For the whole story, send for our free Booklet, "The Story of Victor and Purified Porcelain."

VICTOR NO. 9
LOW VOLTAGE
PINTYPE

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions
Guy Strains • Spools • Switch and Bus Insulators
Custom Designed Porcelain

make FAST work of the BIG tie-ups!

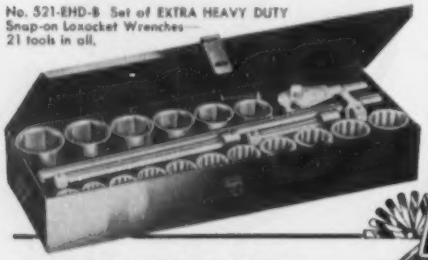
Snap-on* EXTRA HEAVY DUTY

LOXOCKET WRENCHES

● Because most machine maintenance jobs begin and end with wrench work, *the better your wrenches the faster, surer, safer the job.* Above is a perfect example—no room for a ratchet head or an open-end. But a Snap-on Extra Heavy-Duty Sliding Bar and proper socket gives a man a sure grip and sweeping power.

The full Standard Set of these powerful tools, pictured below, will give your crew the *right* equipment to break loose those big, rusted-on nuts and bolts, or to tighten them up to the limit . . . with no time-wasting makeshifts. There are many more shop-proved Snap-on tools that will save money in your plant—more than 4,000 to meet the widest range of needs. Snap-on gives you close-at-hand service through factory branch warehouses in principal industrial centers. Write for the Snap-on Special Industrial Catalog and 104-page General Catalog.

No. 521-EHD-B Set of EXTRA HEAVY DUTY Snap-on Loxocket Wrenches— 21 tools in all.



SNAP-ON TOOLS CORPORATION

8108-B 28th Avenue, Kenosha, Wisconsin

*Snap-on is the trademark of Snap-on Tools Corporation.

Coming New Equipment

Received Too Late for This Issue

Secondary Capacitors

Westinghouse Electric Corp—Are rated 216 v and are completely submersible

Watthour Meter

General Electric Co—Is rated at 50 amp and is accurate up to 200 amp

Suspension Insulators

A new line of suspension insulators, called Microglaze insulators, is said to be manufactured by an accurately controlled process so that optimum glaze thickness is obtained to provide peak insulator strength. Principal advantage of these insulators is their reliability.

Microglaze insulators are available in sizes of 6, 7½, 10, and 12 in. diam with dry flashover values ranging from 60 to 95 kv. Tensile strength ranges from 10,000 lb for the small insulator to 36,000 lb for the large-size insulator.

Locke Dept, General Electric Co, P. O. Box 57, Baltimore 3, Md.

Lightning Arrester

A new valve-type arrester provides lightning protection for ac circuits of 0-175 v or dc circuits of 0-30 v. Type L is designed to furnish consistent sparkover, high-discharge capacity, and low IR drop.

Arrester consists of a precise spark gap and valve element in a clear plastic housing, all mounted on a Bakelite base. Arrester is said to have a positive moisture-proof seal.

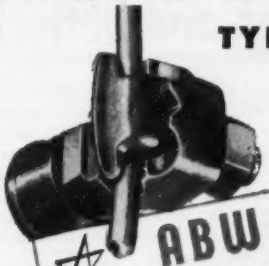
Line Material Co, 700 W. Mich. St, Milwaukee 1, Wis.

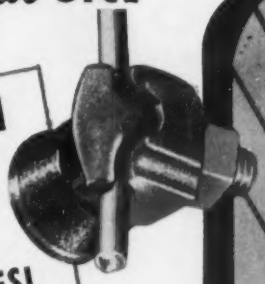
for LIFETIME SERVICE

Specify ANDERSON

TRANSFORMER GROUND CONNECTORS

TYPES GTCS and GTCL

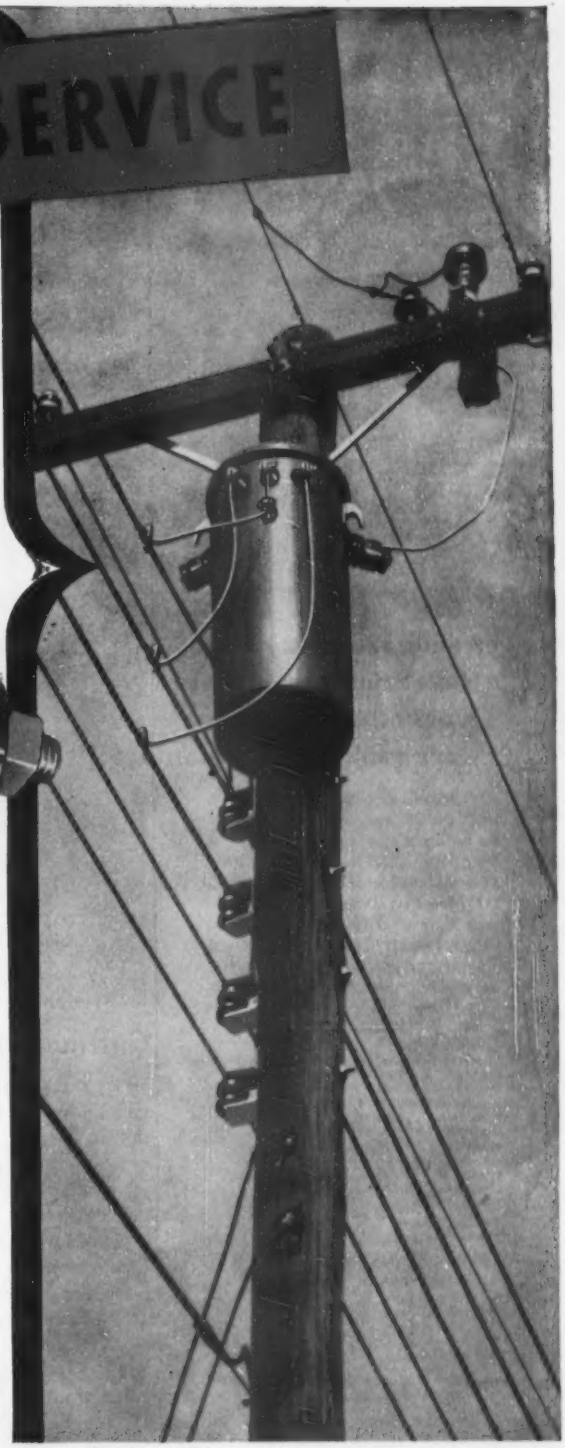




ABW DESIGN MEANS QUALITY Plus STRENGTH in the RIGHT PLACES!

THESE bronze transformer tank to cable ground connectors have been designed and made to *complete* a long-life installation! Both types are designed to withstand Mercururous Nitrate Specifications ASTM B-154-51 and the more severe ABW 124-1, which gives you extra, *added* insurance against stress corrosion and seasonal cracking.

In these connectors, like all Anderson products, *the perfect balance* of base metal and alloy is determined by exhaustive engineering and design testing . . . to insure "on the job" safety and continuity of service far beyond ordinary requirements. This extra measure of quality-control is your protection.



Consult one of our nearest 20 representatives or write, wire or telephone our home office.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

THE DIAMOND "UTILISCOPE"
(WIRED TELEVISION)

AN EMPLOYEE WHO...
Requires no pay check
Never makes a mistake
Works 24 hours a day
Never takes a vacation

Many industrial operations that must be watched continuously and formerly required the individual attention of a man, are now being done without the man . . . by using a Diamond "Utiliscope" (Wired Television). The camera takes the place of the man . . . the monitor or receiver brings an exact picture of what is happening (as it happens) to a remote central control point or wherever else desired. Use the coupon below for further information.

TYPICAL USES
Checking remote gauge readings • Watching flow of molten steel • Viewing nuclear research • Observing conditions inside furnaces • Coordinating materials flow on conveyors. • "Utiliscope" (Reg. U.S. Pat. Office).

6700

DIAMOND POWER SPECIALTY CORP. W
LANCASTER, OHIO
Please send me without obligation a copy of new Bulletin No. 1136 showing how the Diamond "Utiliscope" (Wired Television) is being used to cut costs, improve operations and promote safety.
Name
Company
Address

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited — Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment for Industry

Infrared Lamp

A new 1,550-w, 236-v, infrared heat lamp is said to deliver three times as much radiation per square inch as conventional 375-w infrared lamps. It may be operated at three different wattages—650, 900, and 1,550—for close radiation control.

The 6-in. diam lamp is made of Vycor glass and is resistant to thermal shock. A built-in gold reflector projects heat over an angle of approximately 120 deg and maintains a high degree of reflectivity—between 90 and 95%—of its initial value through life, it is claimed.

Sylvania Electric Products Inc, 1740 Broadway, New York 19, N. Y.

Cutting Tool

Two shear-type cutting tools have passing jaws notched to lock the cable during the cut. The design minimizes crushing or deforming either coarse or fine stranded cable in the rapid cutting action.

Shears will cut ACSR, soft and hard rope, stranded guy wire, and improved plow steel up to Brinell 400 or Rockwell C 42 hardness. The No. 1 TN cutter cuts cable through ⅜ in. diam and the larger No. 3 TN cuts cable through ⅝ in. diam.

H. K. Porter, Inc, 6 Ashland St, Everett, Mass.

600-V Cable

A new 600-v cable is said to be designed for underground feeder service where dampness or corrosive

(*Continued on page* 180)

HANDY ANDY SAYS,

DUXSEAL®
plugs 'em easier-and better!

Duxseal is a nonhardening adhesive plastic compound made with an asbestos base. Stays plastic, will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. Unaffected by water and gases—does not react with rubber, metals or painted surfaces. For full details write Johns-Manville Box 60, New York City 16; in Canada, 199 Bay St., Toronto 1, Ontario.

Duxseal is a general utility sealing and caulking compound for duct openings, potheads, bushings and terminal boxes. Use like putty as it comes from the package

Johns-Manville
SEALING COMPOUNDS

NOT NEW

BUT PROVEN OVER THE YEARS

the "one-piece" jaw used in all FARGO "AUTOMATICS"

*

FAST...SAFE

*

PERMANENT

*

ECONOMICAL

*

for aluminum too!

Ask your Line Material Field Engineer for complete details.

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

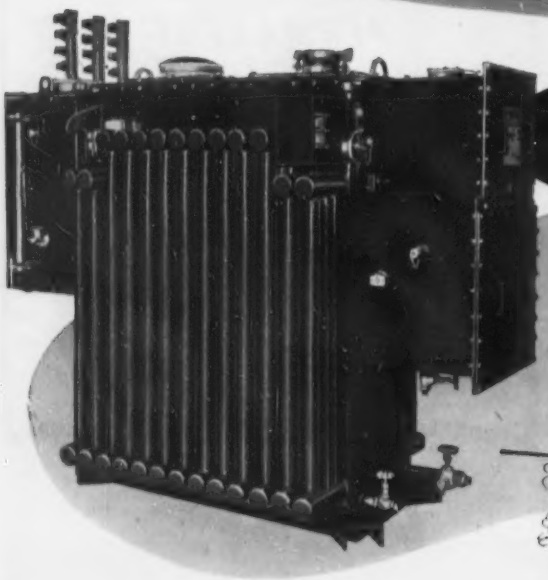
LM®

Above THE GROUND

Type A distribution transformer, 75 KVA, 2400 to 120/240 volts, single phase, 60 cycles, with cover mounted high voltage bushings. Built for pole or crossarm mounting in full accordance with A.S.A. standards.

Standard

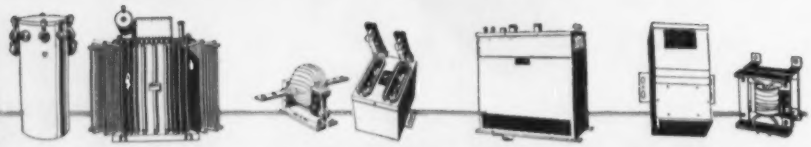
TRADE MARK



Under THE GROUND

Type HTS Askarel subway type network transformer, 500 KVA, 12,470 to 216Y/125 volts, 3 phase, 60 cycles, complete with high voltage disconnect and grounding switch, low voltage network protector, and electrical interlocks.

Transformers FOR EVERY APPLICATION



Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)

Instrument transformers (for use on circuits up to 72,000 volts, inc.)

Dry type (up to 1000 KVA and max. voltage ratings of 4800.)

Control transformers (compound filled or open type.)

On THE GROUND

Type **ATAB** transformer, 10,000/12,500 **KVA**, 3 phase, 60 cycles, voltage 69,000**Y** to 13,200**Y**, with tertiary winding of 3500 **KVA**. Air blast equipment for supplemental rating, low voltage terminal chamber and wheels are accessory equipment.

TRANSFORMERS AT EVERY LEVEL

Installed on thousands of poles throughout the electrical distribution system. On the ground stepping-up or stepping-down at substations. Underground at network load centers. You find STANDARD transformers operating at every level because . . .

. . . users of electrical equipment, having learned through actual experience, place their confidence in the transformers that are built "right" from the ground up. Designed by topflight engineers, constructed by craftsmen who know the importance of following instructions to the letter, then . . .

. . . tested by STANDARD, a recognized leader in the manufacture of Testing transformers. Thus possible future trouble spots are located and eliminated before the transformer leaves the factory. Fully protected from the ravages of dust, dirt, fumes and dampness. Rugged construction allows STANDARD transformers to be used anywhere. Next time remember . . . STANDARD TRANSFORMERS.

Standard

The Standard Transformer Co.

Warren, Ohio

Representatives in principal cities

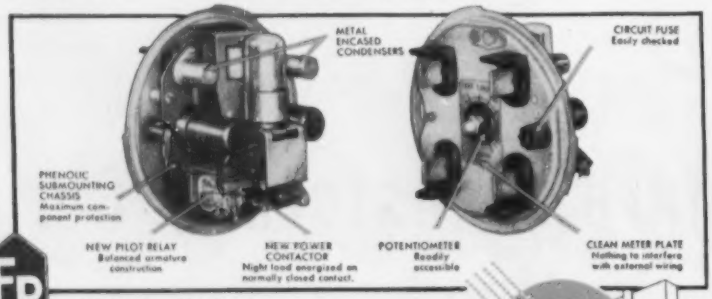
The new improved F-P Control 63300C is the result of eight years of practical experience in photoelectric control for street lighting. Developed in conjunction with leading utility engineers, the new unit provides:

ACCESSIBILITY — The potentiometer is easily adjusted and the circuit fuse quickly changed without removing the meter glass. All major components are readily accessible.

SWITCHING CAPACITY — A SPDT double break power contactor is built into the control chassis. The normally closed contacts energize a lighting load at night up to 3000 watts. The normally open contacts energize a load during daytime up to 2000 watts. These ratings apply to incandescent, mercury or sodium vapor lamps.

PROTECTION — The F-P Series 63300C Control is conservatively rated 3000 volts RMS hipot between any part of the circuit and ground. In the event of functional failure of the circuit, the controlled lighting load will remain on.

HIGHEST QUALITY components are used throughout. All tubes are preaged and tested to give a nominal life of over 20,000 burning hours. All other components have much longer life. Fisher-Pierce Photoelectric Controls have been proven reliable by the experience of hundreds of utilities in thousands of installations.


METAL ENCASED CONDENSERS
CIRCUIT FUSE Easily checked
PHENOLIC SUBMOUNTING CHASSIS Maximum component protection
NEW PILOT RELAY Balanced armature construction
NEW POWER CONTACTOR Night load energized on normally closed contact.
POTENTIOMETER Readily accessible
CLEAN METER PLATE Nothing to interfere with external wiring

Write for Catalog.

The FISHER-PIERCE CO., Inc.

82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILIPS EXPORT CORP. 100 E. 42nd STREET NEW YORK 17, N.Y.

IN CANADA: NORTHERN ELECTRIC CO., Ltd.

New Equipment—

(*Continued from page* 176)

actions are encountered. It is available in single conductor sizes of No. 14 through 4 and in two and three conductor sizes of No. 14 through 10. Single conductor cable is UL approved as Type UF, and two and three conductor construction are approved as both Type UF and NMC.

Single conductor FlexAll has an integrally applied insulation and sheath of Synthinol, Type TW, thermoplastic compound. Two and three conductor cables are insulated with the same compound, and individual conductors are covered with a glass yarn wrap. Over the assembled conductors there is an exterior sheath of Synthinol.

Rome Cable Corp, Ridge St, Rome, N. Y.

Switch Enclosures

Light-weight, lead-plated, sheet-steel enclosures for safety switches are designed for outdoor use where humid, dust-laden, and corrosive atmospheres prevail. Inert lead coating is said to effectively resist corrosive effect of acid, alkali, and salt spray. **Trumbull Components Dept, General Electric Co, Woodford Ave, Plainville, Conn.**

MORE NEW PRODUCTS
about which you should know

L & L Manufacturing Co, Chester, Pa., has a new industrial **electric furnace** the temperature of which can be controlled within ±3F between 500 and 2,300F . . . Wagner Brothers, Inc, 400 Midland Ave, Detroit 3, Mich., announces a line of **electroplating rectifiers** to supply currents up to 50,000 amps.

Square D Co, 6060 Rivard St, Detroit 11, Mich., has a new line of **low-voltage switchboards** that feature an isolated wiring trough, two drop-off openings per section, high-short-circuit capacity of main bus bars, and compact construction . . . General Electric Co, 1 River Rd, Schenectady 5, N. Y., announces a 400-amp, three-phase, dc, **rectifier welder** having a current range from 70 to 500 amp.

Limitorque®

Internationally used for Automatic operation on all types of

VALVES

You can rely on *Limitorque* for . . . safe, speedy, positive, dependable opening and closing on all types of valves . . . globe, gate, butterfly, and plug.

Conveniently located pushbutton stations are the control centers from which even remotely located valves may be operated by highly responsible employees. Greater safety is afforded workmen by *Limitorque Remote Control,* as it is unnecessary to go to high, low or dangerous locations for manual operation. *Limitorque* prevents damage to stem, seat, disc, gate or plug because . . . the torque limit switch gives constant protection to these parts by shutting off the motor if an obstruction should occur.

Limitorque is used in many leading Central Stations . . . Hydro-Electric Plants . . . Public Utilities of all kinds . . . Refineries and world famous oil and gas Pipe Lines throughout the world. It is also used for operating automatic doors, ventilators, damper controls, etc.

Limitorque may be actuated by any available power source . . . electricity, steam, water, gas, oil or air.

Write for Literature and complete details.

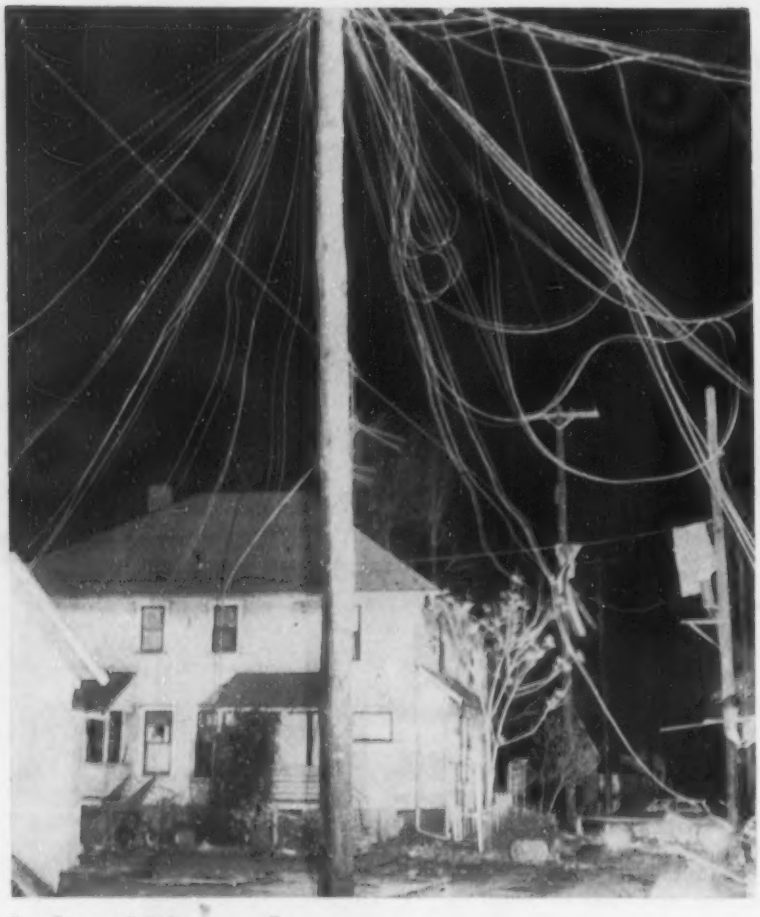
Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

LETTERS TO THE EDITOR



Is It a Wirage?

It was surprising to see Electrical World publishing a photograph which appears to attempt to mislead the reader. I refer to the picture with the headline "Winds Fashion a Yule 'Tree' " appearing in the Dec. 21 issue.

Obviously a treble or quadruple exposure was made which gives the effect of trebling the number of wires—at least the ones which were in motion.

Edward J. Murphy

Dublin, Ireland

• One theory has it that the wind blew the wires (with no effect on stationary house, garage, or poles) while a time exposure was being taken; another that reader Murphy is correct. Take your pick.

Disturbin' Turbines

To the Editor:

Your Nov. 30 issue contains a photo of "A Rig to Dig the Rouge Foundations" and the cutline mentions that the foundations are for two 260,000-kw steam turbines.

Will you kindly advise me who is building these gigantic units. I am interested in power engineering as I am a retired power plant and water supply engineer myself and was of the opinion that the two 250,000-kw Westinghouse turbo-generators for Tennessee Valley Authority's Gallatin plant were the largest at present under construction.

R. N. Austin

New Smyrna Beach, Fla.

• The job was split. Westinghouse Electric is building one, and General Electric the other.

Lifting the Veil

To the Editor:

I want you to know that I think that your article on the one-man power company in the Dec. 7 issue is the best writing I saw last year.

I don't know who wrote the story but the layout, and, in particular, that first sentence are just about perfect. The idea of opening up with a fellow in trouble has always seemed to me a wonderful way to begin any story. And then, if you pelt a couple of stones at him before you finally tell how he rescued himself, you have really got the reader fairly hooked.

John Farley
Publicity Division
Kenyon & Eckhardt, Inc
New York City

• Because we have received so many favorable comments on this article, its author deserves special mention. He's Associate Editor John Wicklein.

Mistaken Figures?

To the Editor:

Your comparison between United States and United Kingdom electrical power rates (EW, Jan. 25, p 145) was very interesting.

Expressed in U. S. currency it would appear that UK rates were reduced between 1948 and 1952:

• Residential by 26% (U. S. by 6.8%)

• Commercial by 31.5% (U. S. by 4.5%)

• Industrial by 23.5% (U. S. by 1%)

This way of putting it makes nationalization appear as a whopping success. It just goes to show that figures can't lie, but they can be made to tell any particular story we have in mind.

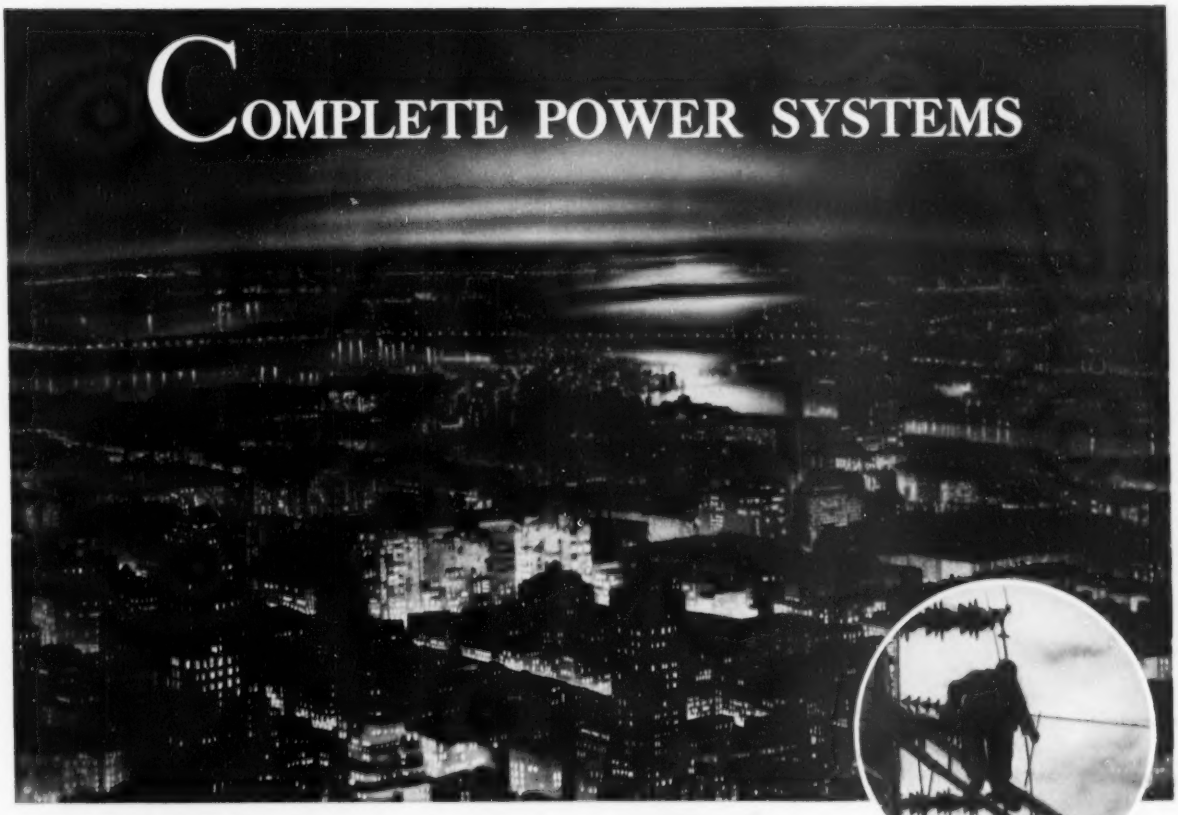
The completely opposite stories told by your way of presenting the matter and the above way is due to the depreciation of the pound from $4.20 to $2.80 between the two years chosen.

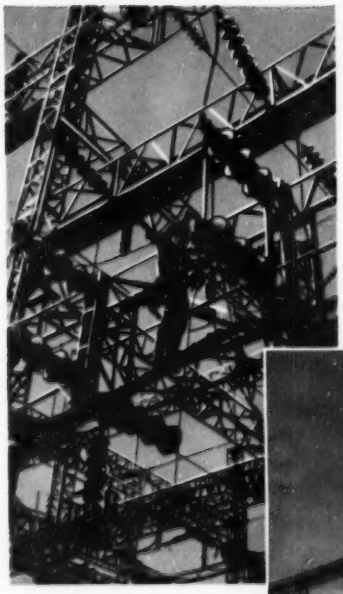
J. P. Thornton

Victoria, British Columbia

• We fail to see that there is any significant relationship between the devaluation of the "pound" and the "dollar" to the level of utility rates within the country.

COMPLETE POWER SYSTEMS





Stone & Webster Engineering Corporation has many years' experience in the design and construction of complete power systems to serve industries or entire communities.

The Corporation's service includes the initial planning of the system; forecast of loads; design and construction of generating units; transformer facilities; switching distribution; location and construction of transmission lines and substations; interconnection; and the determination of equitable rates.

This experience is available for any phase of the design and construction of power systems.

Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Toronto

DOW

THERE IS NO "OFF-SEASON" FOR DOW BRUSH KILLERS

Basal bark treatment with ESTERON 245

or ESTERON BRUSH KILLER gives you good control in all seasons

Brush control with Dow brush killers is *always* in season. When your spraying program includes basal bark treatment of dormant brush and trees in addition to regular foliage spraying, you keep your crews busy and your equipment in use more months each year.

Winter has been established as a good time for basal bark application. This important maintenance practice —spraying Esteron® Brush Killer or Esteron® 245 in oil on the basal 12 to 15 inches of brush stems or tree trunks—has proved its worth on many miles of roadside and right-of-way spraying.

Esteron Brush Killer is a mixture of low-volatility propylene glycol butyl ether esters of 2,4-D and 2,4,5-T. Esteron 245 contains the same type esters of 2,4,5-T only. Both products are effective for foliage and year-around basal bark spraying—for chemical treatment after frilling—and for spraying freshly cut stumps to prevent resprouting. Dow sales and technical men are available for consultation and assistance. We offer valuable technical literature on right-of-way vegetation control with Dow brush, weed and grass killers. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

you can depend on DOW AGRICULTURAL CHEMICALS

DOW

CATALOGS • BULLETINS

● **STUD CONNECTORS:** A 23-page publication, "Handbook of Equipment Terminals", describes various type copper-alloy, stud connectors. Royal Electric Manufacturing Co, 1122 E 87th St, Chicago 19, Ill.

● **ALUMINUM CONNECTORS:** Catalog AL55, 12 pages, presents aluminum electrical connectors recommended for aluminum to copper and all aluminum bus. Burndy Engineering Co, Norwalk, Conn.

● **TUBE MANUAL:** A 578-page, loose-leaf, manual is available with general, operating data on Amperex tubes and tube accessories. Price $2.00. Amperex Electronic Corp, 230 Duffy Ave, Hicksville, N. Y.

● **METAL PRESERVATION:** This booklet is a quick reference guide to chemicals and processes for preserving metals. American Chemical Paint Co, Ambler, Pa.

● **ULTRASONIC GAUGING:** A four-page folder presents data for selection of an ultrasonic thickness-measuring instrument that is suited to a particular problem. Branson Instruments, Inc, 430 Fairfield Ave, Stamford, Conn.

● **LIGHTING FIXTURE:** Bulletin No. 137-53 contains information on two pendant-type lighting fixtures for high-bay areas. Steber Manufacturing Co, Broadview, Ill.

● **MECHANICAL RECTIFIER:** Bulletin GEA-6083 has information on mechanical rectifiers that are rated 12,000 amp, 250 v and 6,000 amp, 250 to 400 v. General Electric Co, 1 River Rd, Schenectady 5, N. Y.

● **CABLE CLIPS:** A four-page bulletin describes an Insuloid Manufacturing Co, Ltd, line of insulated cable clips and ring lock bushings. Lewis Electrical Equipment Co, 5309 Germantown Ave, Philadelphia 44, Pa.

● **SPLICING KITS:** Bulletin CJ6R covers two-way straight and three-way wye joints for single and three conductor, unshielded and shielded, rubber-insulated, neoprene-jacketed cables in sizes No. 8 to 1,000,000 cir mil and voltages to 15 kv. G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

● **THERMOCOUPLES:** A 36-page bulletin, 235-5, lists, with specifications, standard thermocouples and a complete parts list for each type. Foxboro Co, Foxboro, Mass.

● **ELECTRIC HEATERS:** A 60-page bulletin, GEC-1005E, is the 1954 edition of Calrod electric heaters and heating devices catalog and covers application, special features, installation, and pricing. General Electric Co, 1 River Dr, Schenectady 5, N. Y.

● **EXPLOSION-PROOF SWITCHES:** Data Sheet 84 covers Micro explosion-proof switches for use as limits, safeties, and interlocks. Minneapolis-Honeywell Regulator Co, Freeport, Ill.

● **POTENTIOMETER:** A 6-page brochure, No. 3591, describes a wire-wound trimming potentiometer with resistance values from 250 to 25,000 ohms. Bourns Laboratories, 6135 Magnolia Ave, Riverside, Calif.

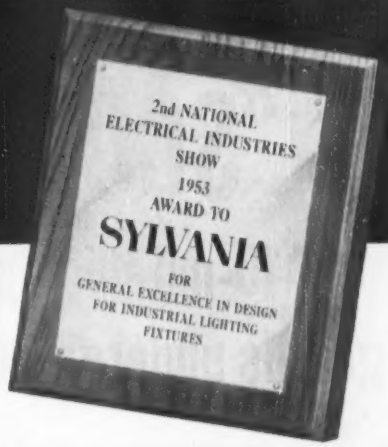
● **LUMINAIRE:** An eight-page booklet contains technical and descriptive information about a lighting fixture that can be surface or pendant mounted. Smithcraft Lighting Division, 233 Everett Ave, Chelsea, Mass.

● **VOLTAGE TESTERS:** Several voltage testers and a tester and fuse puller are described in a 2-page bulletin. Holub Industries, Inc, Sycamore, Ill.

BEST DESIGNED INDUSTRIAL FIXTURE

New Sylvania IC Fixture...

wins award for best design at Electrical Industries Show



SAVES MAINTENANCE DOLLARS, TOO!

In addition to top design honors, this improved Sylvania IC Fluorescent Fixture also wins in lighting efficiency and low maintenance.

Metal parts are Bonderite treated to resist deterioration. Channels, shielding, and steel panels finished in Sylvania's Miracoat baked enamel offer 86% reflectivity . . . keep their high efficiency for years.

Wonderfully versatile!

This fixture meets the needs of scores of industrial applications calling for high levels of illumination. Available in 4, 5, and 8-foot lengths, with V-type crosswise shielding or 45 x 45° louvers. Also may be equipped with the new T-17 low-brightness lamps for critical seeing tasks such as the machining of specular metals.

For full details about this important fluorescent unit, see your Sylvania Representative or write to Dept. 4X-2805, Sylvania.

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg. St. Catherine Street, Montreal, P. Q.

LIGHTING • RADIO • ELECTRONICS • TELEVISION

"SCOTCH" 22

10-mil thick plastic tape guards underground cable splices

Workman applies tape in half-lapped layers

Two half-lapped layers of "Scotch" Plastic Electrical Tape No. 22 give extra-long life to underground cable splices, protect against moisture, acids, oils and abrasion.

Because No. 22 (10 mils) is thicker than conventional plastic tapes, it provides better protection than would ordinary tapes on this application.

Yet "Scotch" 22 is easy to apply. The pressure-sensitive adhesive sticks at a touch and sticks *tight*. The plastic backing stretches to conform smoothly to curves and contours.

And "Scotch" 22 has a dielectric strength of 10,000 volts.

Try this remarkably tough tape yourself—on *all kinds* of insulating and protecting jobs. Available in 36-yard rolls. Standard widths: ½", ¾", 1" and 2". See your supplier, or write Minnesota Mining and Manufacturing Co., Dept. EW-24, St. Paul 6, Minnesota, for complete information.

The term "Scotch" and the plaid design are registered trademarks for the more than 300 pressure-sensitive adhesive tapes made in U.S.A. by **Minnesota Mining and Mfg. Co., St. Paul 6, Minn.**; —also makers of "Scotch" Sound Recording Tape, "Undereal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N.Y. In Canada: London, Ont., Can.

3M COMPANY

SCOTCH BRAND Electrical Tape No. 22

TECHNICAL LITERATURE

RELAY SYMPOSIUM PAPERS—"Symposium on Electro-Magnetic Relays" is the title of a brochure containing papers selected from those given at the two-day Symposium on Electro-Magnetic Relays at Oklahoma A&M College. The selected material presents information pertinent to the design, manufacture, and use of relays. Potter & Brumfield, Princeton, Ind.

MECHANICAL VIBRATION—This 308-page book by G. W. van Santen discusses the theory involved in vibration phenomena. It is believed to be of interest to those involved in problems arising from vibration, or whose work entails the measurement of vibration. Price $7.50. Elsevier Press Inc, 402 Lovett Boulevard, Houston 6, Texas.

LUMINOUS CEILINGS—A 14-page brochure entitled "Design Data and Laboratory Tests on the Use of the Plenum above Acusti-Luminous Ceilings" is based on tests carried on by the Illinois Institute of Technology. It answers many of the questions that arise concerning the use of the plenum for either heating or ventilating. Luminous Ceilings Inc, 2506 West North Ave, Chicago 47, Ill.

TRANSFORMER ASSEMBLY—A pre-assembled, single-tank transformer assembly embodying standard distribution core-and-coil assemblies is discussed in a bulletin entitled "The Power Pac Assembly—A New Type of Pre-Assembled Distribution Unit". The pamphlet also includes outline drawings of primary and secondary connections as well as cost analysis of vault installations. Pennsylvania Transformer Co, P. O. Box 330, Cannonsburg, Pa.

STEEL ELECTRICAL RACEWAYS—A 132-page manual on how to solve the problems encountered in the design and installation of wiring systems using steel conduit raceways has been announced. Arrangement of text and illustrations is for architects, engineers, contractors, electrical apprentices and technical students. The fundamentals of good wiring design, inside and outside, plus a reference guide to related National Electrical Code requirements, and tools and equipment for proper installation are fully covered. Write to Rigid Steel Conduit and Electrical Metallic Tubing Section, National Electrical Manufacturers Assn, 155 East 44th St, New York 17, N. Y. on identifying letterhead.

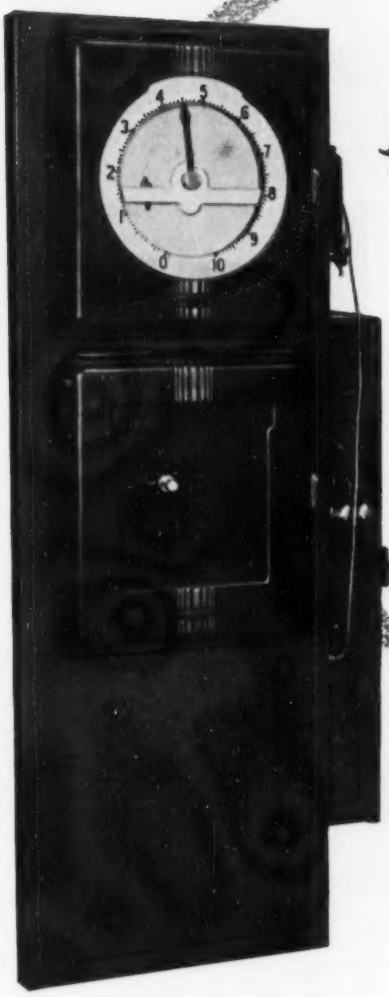
INDUSTRIAL POWER DISTRIBUTION—A 27-page guide to modern plant electric power distribution practices is available from General Electric. Twelve ideas that can help to maintain power continuity, reduce installation and operating costs, safeguard personnel and equipment, and plan a system quickly and easily are covered in detail. Ask for GEA-5900 from General Electric Co, Schenectady 5, N. Y.

FLUORESCENT LAMP DIMMING CONTROL—A simple new three-part electronic dimming system varies the brightness of hot cathode fluorescent lamps, a milestone in fluorescent lighting history. Write for GER-729A to General Electric Co, Schenectady 5, N. Y. for technical paper, or contact nearest apparatus sales office for detailed equipment information.

ASTM STANDARDS—The American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa. has issued the following material:

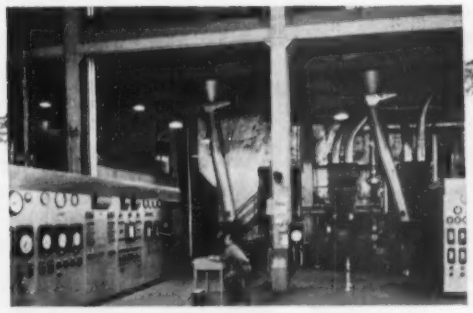
ASTM Standards on Paper and Paper Products and Shipping Containers (with related information)—$3.50

ASTM Standards on Textile Materials (with related information)—$5.25



NEW PERFORMANCE for COMBUSTION EQUIPMENT

with the L&N Magnetic Oxygen Analyzer



Typical plant where L&N oxygen recording equipment keeps total oxygen completely and accurately recorded, for more efficient combustion control.

Rugged, stable and precise, this unique analyzer detects the percentage of oxygen in flue gas from boiler furnaces by a thoroughly-engineered use of the established paramagnetic principle of analysis. Since oxygen is the most reliable index of excess air, these desirable advantages are now made possible:

(1) combustion efficiency goes up (2) fuel costs go down, and (3) maintenance time is cut to the barest minimum.

To triply assure you of best results, Leeds and Northrup has teamed up this advanced instrument with the Speedomax® Recorder and a sampling unit experience-engineered for reliable operation.

This efficient combination offers you this warranted and superior performance:

- Calibrated Accuracy: ± 0.15% oxygen against standard gas mixtures
- Sensitivity: Better than ± 0.05% oxygen
- Stability: Better than ± 0.15% oxygen
- Speed of Response: Initial—8 to 12 seconds; 90% of final reading—35 seconds

To revitalize your fuel-burning efficiency, remember that L&N oxygen equipment gives you . . . a rapid response to oxygen for "tight" combustion control . . . an accurate check on air with no need for tank samples . . . the most practical answer to continuous, trouble-free operation.

For further information, write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

LEEDS NORTHRUP
instruments automatic controls • furnaces

Jrl. Ad. ND46-91(4)

NEWS ABOUT PEOPLE

MacInnes Made President . . .

. . . of Tampa Electric. Utility veteran resigns from Stone & Webster post to accept presidency with Florida organization

William C. MacInnes has been elected president of Tampa (Fla.) Electric Co to succeed the late Francis J. Gannon (EW, Feb. 1, p 55).

Active in the utility field for more than 25 years, MacInnes has been a vice president of Tampa Electric since 1945 and a vice president of Stone & Webster Service Corp for the past 13 years.

In his capacity as a Stone & Webster official, MacInnes had been directly concerned with the planning, financing and operation of Tampa Electric for a number of years.

MacInnes is resigning from the Stone & Webster post to take up his duties as president of Tampa Electric. He will make his headquarters at Tampa, Fla.

Electrical Engineer . . . A native of Nova Scotia, Canada, MacInnes was graduated from Massachusetts Institute of Technology in 1927 as an electrical engineer. From 1927 to 1930 he was with Savannah (Ga.) Electric & Power Co. For the next five years he was with Sierra Pacific Power Co, Reno, Nev., serving as assistant to the president of the power company.

He was then employed by Stone & Webster Service in its New York office until 1937 when he became president of the West Coast Power Co, Portland, Ore. He remained in that position until 1941 when he was appointed vice president of Stone & Webster Service with headquarters at New York.

DON C. BLANCHARD

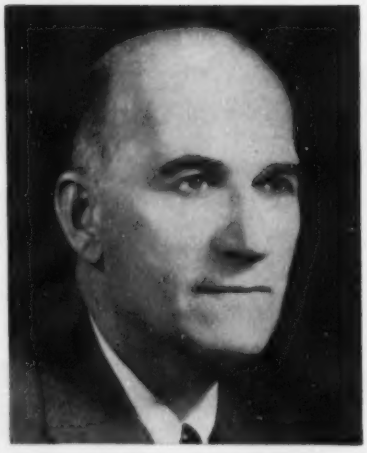
EDWARD A. LEACH

Blanchard, Leach Appointed VP's

Don C. Blanchard and Edward A. Leach have been elected vice presidents of Sangamo Electric Co, Springfield, Illinois.

Blanchard, who becomes vice president and factory manager, will continue his present duties as production manager, a post he has held since 1948. He joined Sangamo in 1937 after graduating from Illinois College, Jacksonville, Ill.

Leach, who becomes vice president in charge of factory engineering, will continue his present duties as manager of the engineering department and factory drafting. Leach, who joined Sangamo in 1948, earned a master's of science degree in electrical engineering from Massachusetts Institute of Technology in 1928.



W. D. SULLIVAN

Sullivan Elected a VP of Babcock & Wilcox Co

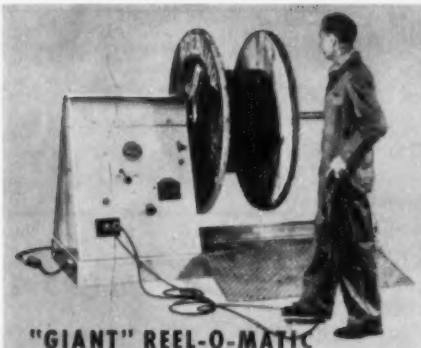
Babcock & Wilcox Co, New York, has announced the election of W. D. Sullivan as vice president in charge of the Boiler Division's manufacturing department to succeed Vice Pres M. Nielsen, who was put in charge of that division. In addition to his appointment as head of the Boiler Division, Nielsen was elected a member of the board of directors.

Sullivan, formerly regional manager of the manufacturing department, joined Babcock & Wilcox in 1916. Three years later he transferred to the Tubular Products Division at Beaver Falls, Pa., advancing to assistant works manager. Last August he assumed the regional manager's post.

With Babcock & Wilcox since 1924, Nielsen has had wide experience in the erection, contract, and manufacturing departments of the company. He was elected an assistant vice president in 1952 and vice president in charge of the Boiler Division's manufacturing department in 1953.

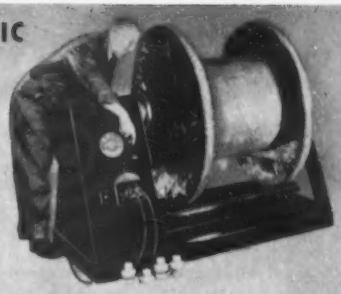
Elected Executive VP

J. C. Sullivan, treasurer of Pittsburgh Reflector Co, has been appointed executive vice president of the company. Sullivan, with the company for the past 28 years, will now be in charge of general operations and administration of the sales department. He will co-ordinate firm's sales of commercial and industrial fluorescent and incandescent lighting equipment.

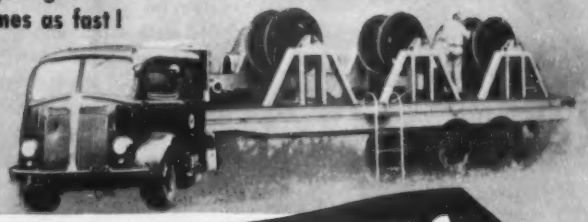


"GIANT" REEL-O-MATIC
Model 30-60...
Handles the largest reels

Model A—REEL-O-MATIC
Motor Driven
Platform with foot
-and-finger controls



REEL-O-MATIC
HIGHLINE UNIT
cuts costs by ⅔—
lays highline
3 times as fast!



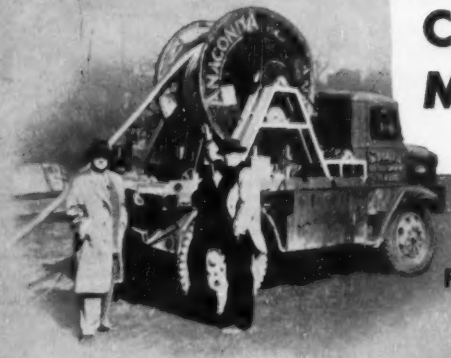
"MIDGET" REEL-O-MATIC
for "Reel" efficiency and economy

REEL-O-MATIC

LOWERS COSTS—INCREASES EFFICIENCY...

...for handlers of...

CABLE • WIRE ROPE
MESSENGER STRAND



REEL-O-MATIC
T-P UNIT
For Highline and Underground Cable Jobs

Write today

for Free Catalog describing the complete REEL-O-MATIC line of cable and wire rope handling equipment . . . ask for engineering advice on special problems.

A REEL-O-MATIC earns money for you by drastically reducing the costs of handling cable, wire rope, messenger strand, etc. In a matter of minutes, one man can measure, coil, and cut an order to specification . . . saving time, handling, and labor! REEL-O-MATIC does a *better* job faster.

In addition to the standard models shown, special REEL-O-MATICS are constantly being developed to suit specific needs . . . the REEL-O-MATIC principle has been successfully adapted to meet many unusual requirements of the U. S. Government, as well as private industry.

To ease your cable and wire handling problems, investigate REEL-O-MATIC . . . now!

REEL-O-MATIC CORPORATION of AMERICA
COLUMBIA 2, PENNA.

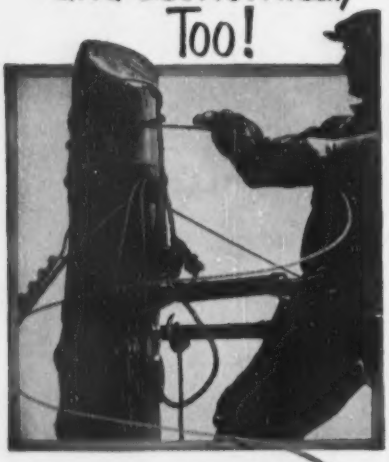
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!



● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

3 Penelec, Meted Officials Are Assigned New Duties

O. Titus, president of Pennsylvania Electric Co and Metropolitan Edison Co, has assigned additional duties to three executives of the companies.

Titus announced that T. O. McQuiston, vice president and general sales manager for Meted, will also serve as system residential and commercial sales manager for Penelec. W. C. Sontum, engineering vice president and a member of the board of directors of Penelec, will be engineering co-ordinator of the two companies. In addition, P. R. Lawson, comptroller of Penelec, takes on duties of accounting co-ordinator of Meted.

McQuiston served with Philadelphia Co and Duquesne Light Co before joining Meted in January, 1950, as sales manager. In October of that year he was made vice president and general sales manager. Sontum was associated with Penn Public Service Corp, a predecessor of Penelec, before he was made superintendent of operations for Penelec in 1937. In 1942 he was appointed vice president in charge of operations and two years later was named to his present post.

Lawson has been with Penelec since 1944, serving as treasurer until he was named comptroller in 1946.

WILBUR S. HOLTON

Orangeburg's New VP

Wilbur S. Holton, assistant general sales manager of Orangeburg Manufacturing Co, Inc, has been elected vice president of the company. The newly elected official joined Orangeburg in 1929 as a member of the firm's Underfloor Duct Sales Division. He

Simple, low cost way
TO KEEP NUTS TIGHT

Spin on a
PALNUT LOCK NUT

LOCK IT *in seconds...*
FORGET IT *for years*

Whether you build equipment, or buy equipment, specify PALNUT Lock Nuts to assure tight assemblies for the life of your equipment. Cut down troubles — reduce maintenance — improve operating characteristics.

PALNUT Lock Nuts cost little, apply fast, exert a double locking spring action that prevents nut from loosening and bolt from backing out. Require only 3 bolt threads. Easily removed and re-used when servicing.

Widely used in Utility field

PALNUT Lock Nuts have been used for years on wood pole, steel towers, fittings, connectors, switches, hardware, transformers, etc. Parkerized and hot dip galvanized steel; also silicon bronze. Get Bulletin #577 and samples.

THE PALNUT COMPANY

51 Cordier St., Irvington 11, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

40 PAGES of helpful information

on Recovering Dusts, Fly Ash, Mists, Fumes and other Suspensions from Gases.

This booklet summarizes

the important points design and plant engineers should know about Cottrell Precipitators . . .

- Basic types of Cottrell equipment.
- Principal elements in a Cottrell unit.
- Data on Mechanical and Electronic Rectifiers.
- Various types of Collecting Electrodes (rod curtains, corrugated plates, pocket electrodes, etc.).
- Typical ways of removing collected material.
- Various Shell Constructions (steel, concrete, brick, etc.).
- The effect of various factors on efficiency and performance.
- Data on CMP (Combination Multiclone-Precipitator) Units.

. . . and many other helpful facts on Cottrell design and operation.

Latest data from Western Precipitation on Cottrell Recovery Equipment

Do you have operations in your plant where gas-laden suspensions, wet or dry, are a problem? Such suspensions may be dropping on surrounding property, causing nuisance difficulties. Or perhaps important values are being lost in stack gases that can be profitably recovered. Whatever the nature of your recovery requirements, you will find this 40-page Cottrell booklet of great help. It contains up-to-date data on the latest advancements in the electrical precipitation field – prepared by the organization that pioneered the commercial application of Cottrell Electrical Precipitators almost a half century ago and has consistently led in new Cottrell developments.

A copy of this data-packed booklet will be sent free to engineers and other executives interested in recovery processes. Send your request to our nearest office.

For nearly 50 years Western Precipitation has carried on a continuous research and development program on Cottrell Electrical Precipitators, Multiclone Mechanical Collectors and other types of recovery equipment. We are not affiliated with any other company in the electrical precipitation field except our wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. We are equipped to serve you anywhere in the United States, Canada, and throughout the world!

WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

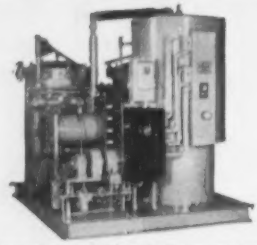
TRANSFORMER OIL PURIFICATION *with the* HILCO HYFLOW OIL RECLAIMER

reduces costs of

1 TRANSFORMER MAINTENANCE

2 OIL REPLACEMENT

With this 300 g.p.h. mobile Hilco Reclaimer the City of Tacoma, Washington, purified 100,000 gallons in three months at a saving of $20,000.



Cincinnati Gas & Electric Company reports an annual saving of $4,000 with this stationary Hilco Reclaimer.

The HILCO HYFLOW Oil Reclaimer combines a duplex fullers earth filter with a vacuum vaporization system to remove water, sludge, soluble oil oxidation products, paint, bushing compound, metallic soaps, etc. Oil is restored to new oil values as indicated by Neutralization Number, Interfacial Tension, and other tests.

• *FOR COMPLETE INFORMATION WRITE*

THE HILLIARD CORPORATION

1000 W. FOURTH ST. • ELMIRA, N. Y.

IN CANADA: Upton - Bradeen - James, Ltd. 900 Bay St., Toronto; 3484 Park Ave., Montreal

was appointed Eastern district sales representative for the company in 1939, and was named assistant general sales manager in 1950.

Heads Iowa Utility Group

P. L. Mercer, manager of the Iowa Division of Union Electric Co, Keokuk, Iowa, has been elected president of the Iowa Utilities Association to succeed Edward Ruisch, assistant to the president of Iowa Public Service Co. Other association officers elected for 1954 include vice president, J. T. Schilling, executive vice president, Iowa Power & Light Co; and second vice president, C. P. Conrad, president, Iowa-Illinois Gas & Electric Co. Ben A. Webster was re-elected as executive secretary and Carroll E. Worlan was re-elected as assistant to executive secretary.

•

John A. Gilbreath, formerly assistant vice president of Servel, Inc, has been appointed division manager of Westinghouse Electric Corp's new Air Conditioning Division, which will be located at Staunton, Va. Gilbreath had been with Servel since 1945, serving in various capacities.

Albert B. Stevens has been named assistant sales manager of the Pole Hardware Division of Malleable Iron Fittings Co, Branford, Conn. Prior to joining Malleable, Stevens was associated with Southern New England Telephone Co.

OBITUARY

James A. Ward

James A. Ward, 73, president of California-Pacific Utilities Co since 1935, died at San Francisco Feb. 1.

Ward, who was educated at Purdue University and Armour Institute of Technology, entered the utility field in 1903. He worked for several South Dakota and Wyoming utilities before going to Northwestern Public Service Co as vice president and manager. He then served as vice president and general manager of Ohio Electric Power Co from 1927 to 1930. At that time he went to San Francisco to join Republic Electric Power Corp, which he served first as vice president and later as president. He continued in the later capacity with California-Pacific Utilities when it was organized in 1935.

JAMES A. WARD

George F. Hessler

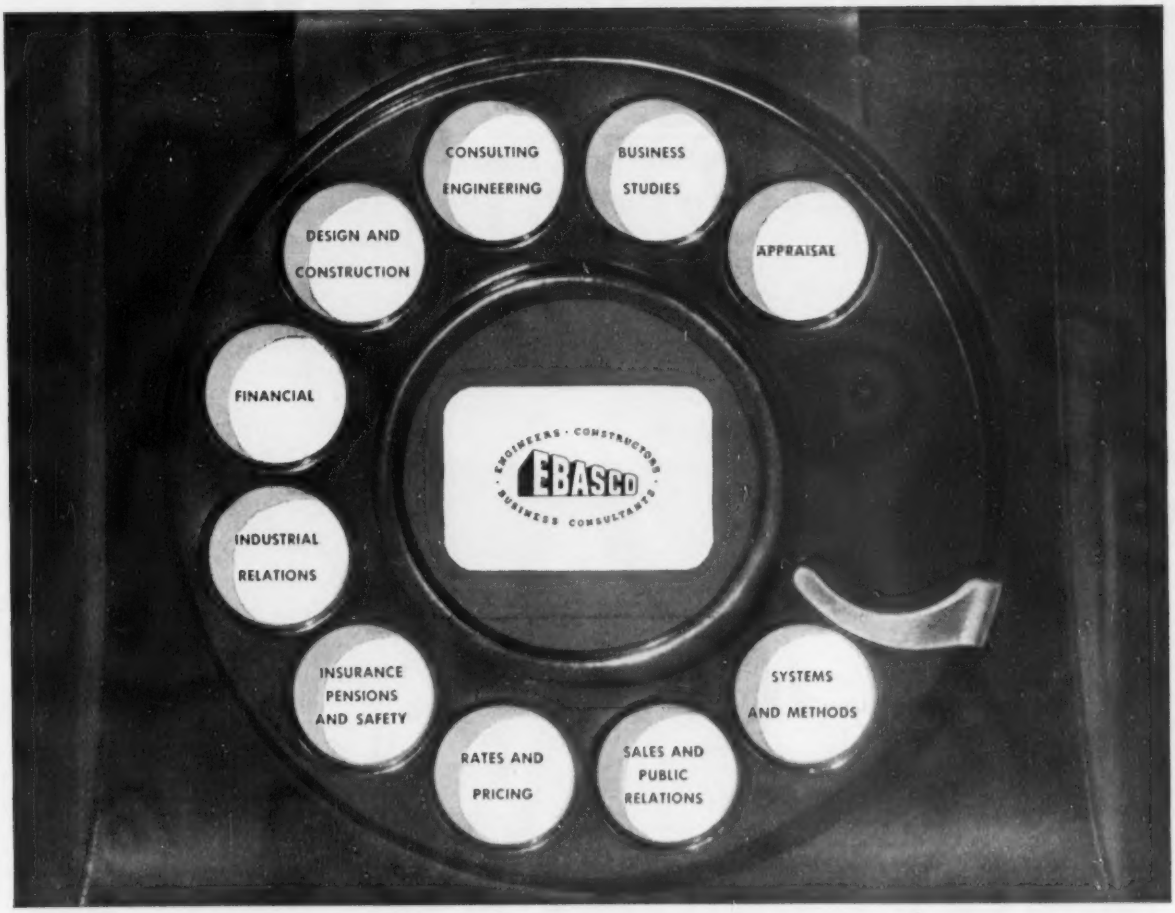
George F. Hessler, 64, vice president in charge of all sales activities and a member of the board of directors and executive committee of Graybar Electric Co, died Feb. 1 at Venice, Fla.

With Graybar 48 years, Hessler served as general sales manager for two years before becoming a vice president and a member of the executive committee in 1942. Hessler, who was made a director in 1941, had headed all the firm's sales activities since 1949.

Active in the National Association of Electrical Distributors since 1916, he was president of the group in 1952 and 1953 and also was a member of its Washington Committee, which was formed during World War II to interpret basic war needs of the electrical industry. As a result of his NAED work, Hessler received the James H. McGraw Award for Electrical Men in 1952 for assisting in formulating regulations of Office of Price Stabilization.

Sir Ernest J. P. Benn, 79, who was from 1922 to 1941 chairman of Benn Brothers, Ltd, London, publishers of Britain's "Electrical Journal" and technical books, died recently at Oxted, England.

Charles N. Daus, 53, New England States sales promotion manager for Westinghouse Electric Corp, died Feb. 1 at Hartford, Conn.



When you call for these services in 1954....

Like most utility companies, chances are your firm needs services like these. Since few companies maintain staffs large enough to include specialists in all these fields, more and more management men are finding that the best way to get the assistance they need is to call an organization like Ebasco.

For when you call Ebasco, you call a team of specialists—engineers, constructors, business consultants—men whose technical talents are at a premium in today's tight manpower market. They provide you with the service your particular problem requires—and do it without adding to your permanent payroll, overburdening your busy staff or wasting the valuable time of your top executives.

Next time a need arises in your company for special assistance in any phase of business operations, ask your operator to connect you with Ebasco.

For more details on how you can put this reservoir of experience to work for you, write for your free copy of "The Inside Story of Outside Help." Address: Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

NEW YORK • CHICAGO • WASHINGTON, D. C.

Appraisal • Budget • Business Studies • Consulting Engineering Design & Construction • Financial • Industrial Relations • Inspection & Expediting • Insurance, Pensions and Safety • Purchasing Rates & Pricing • Research Sales & Public Relations • Space Planning • Systems & Methods Tax • Traffic • Washington Office

EBASCO
ENGINEERS · CONSTRUCTORS
BUSINESS CONSULTANTS

Ebasco Teamwork gets things done anywhere in the world

Russia Claims Records . . .

. . . in its 1953 production of electrical machinery, appliances, and electricity. Government not entirely satisfied

The Soviet Union has reported new records in production of electrical machinery, appliances, and electricity during 1953.

A breakdown of figures on machinery and appliance output shows the following increases over 1952:

- Steam turbines—40%.
- Large hydro-turbines—35%
- Turbo-generators—47%
- Hydro-generators—15%
- Large electrical machines—34%
- Electric motors—13%
- Radio receivers—27%
- Television sets—125%
- Home refrigerators—59%
- Vacuum cleaners—100%

Altogether, the Ministry of Electric Stations and the Electric Industry fulfilled its overall plan for 1953 by 102%. Fuel consumption per unit of electrical energy production was reduced 1.9%

Small Acorns . . . While sharply higher than in 1952, Russia's electrical appliance output was small by American standards. For example, home refrigeration production was only about 62,000 in 1953, while television output, despite the 125% increase, is not scheduled to reach 500,000 sets a year until early next year.

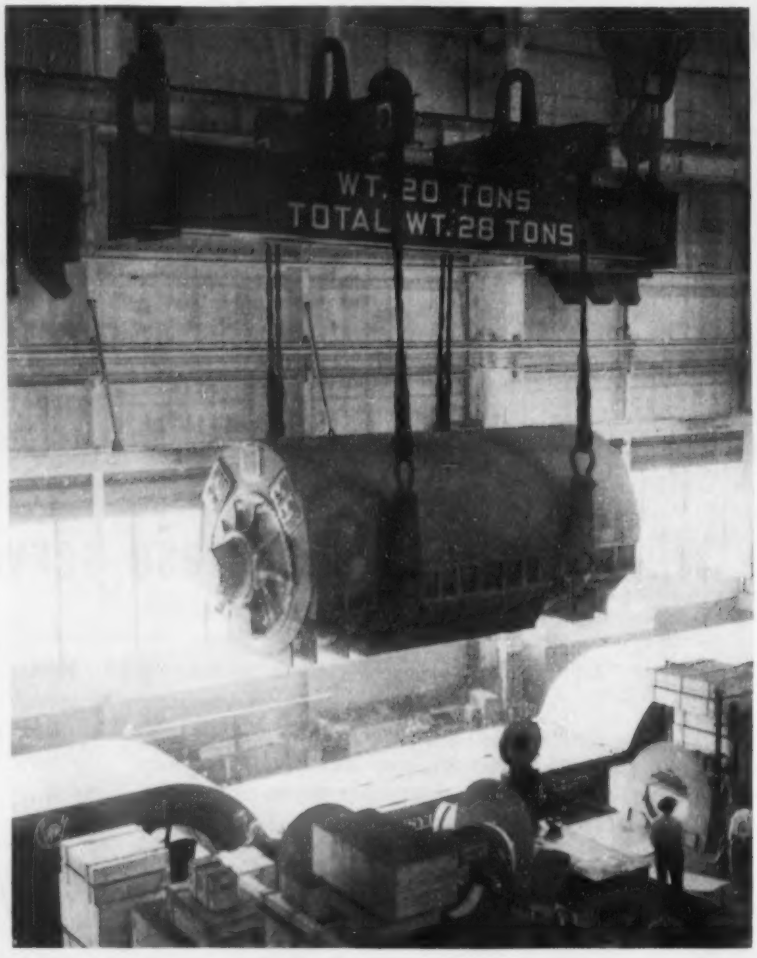
The Russian government itself had some specific complaints against the industry's performance last year. These included the charge that production of "certain types" of generators and electric motors failed to meet assigned quotas. Although capital investment in power plants last year increased as compared with 1952, the total was below plan. The amount of new electric capacity placed in operation last year wa salso not up to government set goals.

Power of Deduction . . . Although the Russians discussed their latest industrial achievements exclusively in terms of percentage gains over previous years, specific figures can be deduced.

Late last year, Premier Malenkov declared that the USSR would produce 133 billion kwhr in 1953. This goal, judging from the Central Statistical Administration's report, was substantially achieved.

Since electric production increased 13% in 1953 and 1952 and 14% in 1951, this means estimated output in 1952 was 117.7 billion, about 104.16 billion in 1951, and 91.4 in 1950. This means a net gain in production of 15.3 billion kwhr in 1953, 13.5 billion in 1952, and 12.8 in 1951.

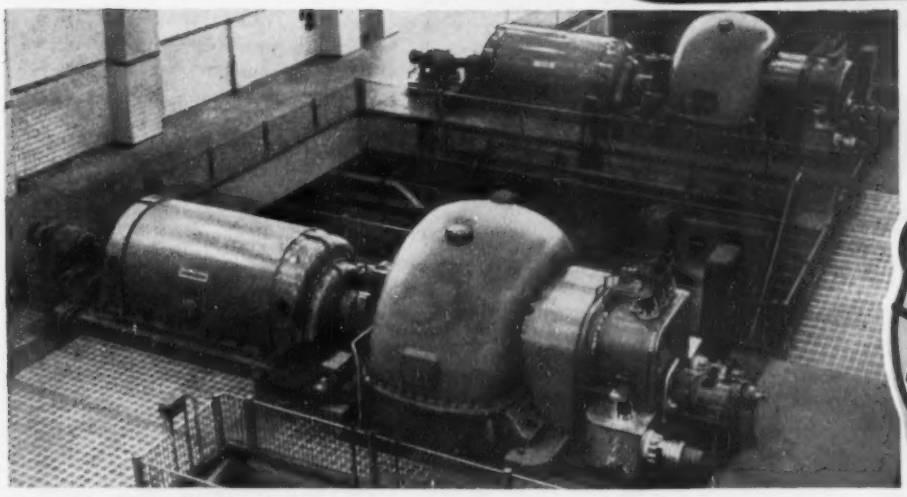
Malenkov also stated that 1953 output would be 2.8 times as high as in 1940, indicating that production was at about 47.5 billion in that prewar year.

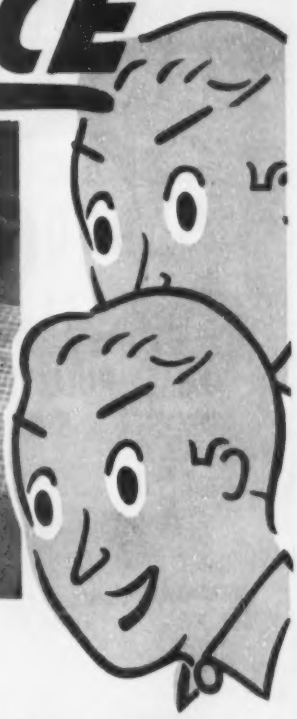


Largest Assembled Generator Shipped

The biggest power package ever transported as a completely assembled unit —a 490,000 lb turbo-generator—was recently shipped from Westinghouse Electric Corp's East Pittsburgh plant. Built for West Penn Power Co's Springdale, Pa., station, the 135,000-kw generator had to be lifted by two overhead cranes and transported on the world's longest railroad car specially constructed for such loads. Thirty-two wheels support the 121-ft, 9-in. car which is capable of carrying 503,000 lb.

you'll look *TWICE*





Brown Boveri 25,000/32,500 kW turbo-generator sets. The City of Cleveland saved enough on the two new units to purchase a third generator, if so desired. They were produced and delivered as scheduled.

at BROWN BOVERI TURBO-GENERATORS

WHEN you realize the basic economies of Brown Boveri turbo-generators embrace *all* of these eight points . . .

1—Top Efficiency
2—Long Life
3—Minimum Maintenance
4—Thorough Dependability
5—Compact Design
6—Low Initial Cost
7—Prompt Delivery
8—Complete Service Facilities

. . . *plus,* of course, world-famous Brown Boveri quality. . . you'll want to take a *second look* at this outstanding equipment (*and give it serious consideration*) by writing TODAY for complete data.

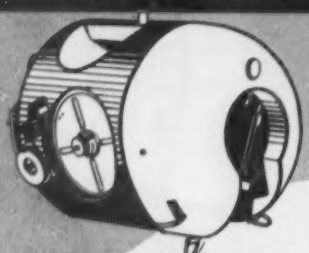
BROWN BOVERI

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

SALES OFFICES: Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Butte, Mont. • Chicago, Ill. • Cleveland, O. Denver, Colo. • Detroit, Mich. • High Point, N. C. • Jacksonville, Fla. • Kansas City, Mo. Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal. • Minneapolis, Minn. • New Orleans, La. New York, N. Y. • Portland, Ore. • San Francisco, Cal. • Seattle, Wash. • Tucson, Ariz.

★STAR PERFORMER



NEALE PULL TYPE MODEL K SPINNER

AND HOW

- Reduces Cost
- Saves Splices
- Cuts Inventories
- Solves "Congested Area" problems

CABLE SPINNING EQUIPMENT CO.
3100 TOPEKA AVE.
TOPEKA KANSAS
Phone 2-7234
OVERSEAS SALES:
Ericsson Telephone Sales Corp. of New York
Automatic Electric of Canada
Pirelli of Great Britain

Refined Copper Output Declines, Stocks Rise

Refined copper shipments to domestic fabricators were the lowest since July, 1949, last month, while stocks on hand were the largest since December, 1949.

According to the Copper Institute, domestic and foreign delivery of copper during January totaled 77,091 tons, a drop of 35,153 tons from the December figure of 112,244 tons. The sharp decline was attributed partly to over-buying by consumers in December for tax-saving purposes.

Meanwhile, producers' stocks rose by 20,409 tons during the month to 108,121 tons on Jan. 31, and mine production of the ore declined to 77,155 tons from 78,500 in December. The latter did not reflect curtailments now being put into effect by at least three major copper producers (EW, Feb. 8, p 158).

On the other side of the coin, foreign producers' shipments of refined copper to users abroad totaled 92,277 tons, the best for any month since April, 1952. Deliveries abroad have risen consistently since the low point of 44,662 was reached in August of last year.

MANUFACTURING BRIEFS

Dow Corning Silicones, Ltd, Canadian subsidiary of Dow Corning Corp, has moved into new office and warehouse building in Toronto. It contains 2,000 sq ft of office space, and 100,000 sq ft of warehouse area.

General Electric Appliances Co has opened a new $750,000 warehouse and office building in Verona, Calif., in the greater Los Angeles area. The 127,000-sq ft facility was introduced to GE dealers and the public at a four-day open house last month.

Victor Insulators, Inc, Victor, N. Y., has completed work on a new ceramic laboratory, which more than doubles the working area. The lab is under the direction of W. O. Young.

Reconstruction Finance Corp has sold $20,991,600 of first mortgage bonds of Reynolds Metals Co to private financial institutions. The sale terminated an RFC investment in Reynolds which began in 1940, when the agency bought $15.8 million of the firm's 4% bonds at the time it became a producer of primary aluminum.

SALES ASSIGNMENTS

COMPANY STAFFS

Southern States Equipment Co has appointed John Tomme representative in New York and the New England states. He has been associated with the company for a year.

Pittsburgh Reflector Co, has named David B. Young sales engineer in Louisiana and southern Mississippi and Lewis A. Steinberg to a similar post in western Pennsylvania, eastern Ohio, and northern West Virginia.

REPRESENTATIVES

Feedrail Corp has appointed M. B. Squires Co as its Pittsburgh representative, covering West Virginia and the portion of Pennsylvania west of but not including the counties of Potter, Clinton, Centre, Huntingdon, and Fulton. Offices are at 1202 Grant Building, Pittsburgh 19.

MEETINGS CALENDAR

National Adequate Wiring Bureau
10th Annual National Adequate Wiring Conference, La Salle Hotel, Chicago, Feb. 25-26.

Pennsylvania Electric Association
Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, Feb. 25-26; Relay Committee, Benjamin Franklin Hotel, Philadelphia, March 4-5.

Public Information Program
East North Central Region Meeting, Hotel Cleveland, Cleveland, Ohio, Feb. 25.

Public Utilities Advertising Association
Region 1 Meeting, Sheraton-Mount Royal Hotel, Montreal, Que., Feb. 25-26; National Convention, Hotel Statler, Boston, May 13-14.

Canadian Electrical Association
Western Zone Meeting, Royal Alexandra Hotel, Winnipeg, Man., March 1-3; Annual Convention, Murray Bay, Quebec, Que., June 24-26.

Southern Safety Conference-Exposition
Kentucky Hotel, Louisville, Ky., March 7-9.

National Electrical Manufacturers Association
Spring Meeting, Edgewater Beach Hotel, Chicago, March 8-11.

***Interstate Power Club**
Meetings will be held at Hotel Martinique, New York, on following dates: March 10, May 10, Oct. 11, Dec. 6.

***American Society of Mechanical Engineers**
International Meeting, through cooperation of Mexico Section, Hotel Del Prado, Mexico City, March 10-12. Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24; Fall Meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 8-10.

National Association of Corrosion Engineers
10th Annual Conference and Exhibition, Kansas City, Mo., March 15-19.

Edison Electric Institute
Industrial Relations Committee, EEI Headquarters, New York, March 18; 20th Annual Sales Conference, Edgewater Beach Hotel, Chicago, April 5-8; EEI-AGA Accounting Conference, Ho-

tel Statler, Boston, April 12-14; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, April 15; 22nd Annual Convention, Atlantic City, N. J., June 1-4.

Pacific Coast Electrical Association
Engineering and Operating Sections, Mark Hopkins Hotel, San Francisco, March 18-19; Administration Services Section, Hotel Claremont, Berkeley, Calif., April 7-8; Annual Convention, Hotel Del Coronado, Coronado, Calif., May 19-21.

North Central Electrical Industries
17th Annual Electrical Industry Convention, Hotel St. Paul, St. Paul, Minn., March 21-24.

Southeastern Electric Exchange
21st Annual Meeting, Boca Raton Hotel, Boca Raton, Fla., March 22-24; Spring Meeting, Engineering and Operation Section, Sans Souci Hotel, Miami Beach, Fla., May 6-7.

***Institute of Radio Engineers**
1954 National Convention, Waldorf-Astoria Hotel and Kingsbridge Armory, New York, March 22-25.

American Power Conference
Sherman Hotel, Chicago, March 24-26.

Northwest Public Power Association
Annual Convention, Winthrop Hotel, Tacoma, Wash., March 31-April 1-2.

***Electrical Industry Show**
Sponsored by Electrical Maintenance Engineers Association of Southern California, Shrine Exposition Hall, Los Angeles, April 1-3.

***Illuminating Engineering Society**
Southern Regional Conference, Roosevelt Hotel, New Orleans, La., April 8-9; Southwestern Regional Conference, Rice Hotel, Houston, Tex., April 11-14; Inter-Mountain Regional Conference, Denver, Colo., April 15-16; South Pacific Coast Regional Meeting, Museum of Art, San Francisco, April 19-20; Pacific Northwest Regional Meeting, Benjamin Franklin Hotel, Seattle, Wash., April 22-23; Canadian Regional Meeting, King Edward Hotel, Toronto, Ont., April 28-30; Great Lakes Regional Meeting, Sheraton Cadillac Hotel, Detroit, May 3-4; Midwestern Regional Meeting, Hotel Jefferson, St. Louis, June 17-19; National Technical Conference, Chalfonte-Haddon Hall, Atlantic City, N. J., Sept. 12-16.

Northwest Electric Light & Power Association
Engineering and Operation Sections, Olympic Hotel, Seattle, Wash., April 15-17; Business Development Section, Hotel Boise, Boise, Idaho, May 10-12.

American Institute of Electrical Engineers
Conference on Feedback Control, Claridge Hotel, Atlantic City, N. J., April 22-23; Northeastern District Meeting, Schenectady, N. Y., May 5-7; Conference on Telemetering, Morrison Hotel, Chicago, May 24-26; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25; Fall General Meeting, Chicago, Ill., Oct. 11-15.

A. & M. College of Texas
7th Annual Conference for Protective Relay Engineers, Department of Electrical Engineering, College Station, Tex., April 26-28.

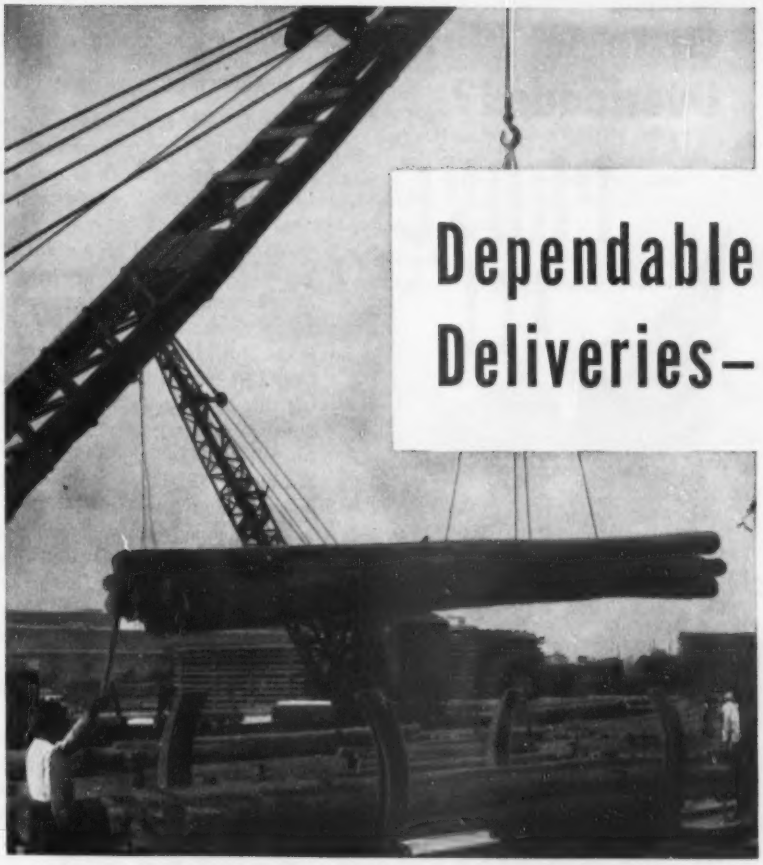
American Public Power Association
Annual Meeting, Hotel Morrison, Chicago, May 4-6.

CIGRE
International Conference on Large Electric High-Tension Systems, Paris, France, May 12-22.

***National Association of Electrical Distributors**
Annual Convention, Atlantic City, N. J., June 6-11; Pacific Zone Convention, Mark Hopkins Hotel, San Francisco, Oct. 4-7.

American Society of Engineering Education
62nd Annual Meeting, University of Illinois, Urbana, Ill., June 14-18.

*Additions this week.



One of our valued customers writes: "We have been buying poles and treated timber from you since about 1930. Your products have been very satisfactory. Also, your service in getting shipments to us has been very prompt."

Koppers Poles go out on schedule!

• Koppers has a "head start" when it comes to pole deliveries. Because Koppers has many wood-treating plants, located in strategic places. And these plants carry ample stocks.

Koppers Poles are *good* poles, too. Pressure-creosoted for their full length, these poles are fully protected against decay, weathering and termite attack. You get long service life from dependable Koppers Poles.

And you can count on *Koppers*, the best known name in pressure-treated wood for quality, service, and experience.

KOPPERS COMPANY, INC.
Wood Preserving Division • Pittsburgh 19, Pennsylvania

KOPPERS ® PRESSURE-CREOSOTED WOOD

Customer Wiring Overloaded?

PROVE IT!

...with the Sprague

ADEQUATE WIRING ANALYZER

This compact Sprague instrument easily and quickly checks wiring to see if it's adequate for present or contemplated loads.

Prove to customers the effect of increasing loads on their wiring *right in their own home.* Direct reading meter indicates percentage voltage drop on 115 or 230 volt circuits under load *without troublesome calculations.*

Connectors for convenience outlets, appliances, panel boards, etc., are furnished—ideal for use in home, farm, or plant.

Write for Bulletin PF-600—
Sprague Electric Company,
315 Marshall Street,
North Adams, Massachusetts

SPRAGUE

PIONEERS IN ELECTRIC AND ELECTRONIC DEVELOPMENT

WWP's Rate Increase

(*Continued from page* 118)

and sufficient, the commission let the rate stand. During hearings, WWP argued that going back to the rate before Jan. 23, 1953, would reduce the return below 5.85%.

The increase had been granted temporarily to permit WWP to arrange a permanent financing program amounting to $25 million to pay bank loans for building Cabinet Gorge Dam. WWP filed the application for the rate increase in September, 1950. It was the only general rate hike ever sought in Washington state by the company, although WWP had reduced rates in 1940 and 1941.

The company anticipated approximately $748,000 in increased revenue from the higher rate. The actual income exceeded this figure slightly.

A similar rate increase in Idaho was granted in February, 1953, by the Idaho Public Utilities Commission, restoring approximately 50% of a rate reduction made in 1941. Increased WWP revenue in Idaho was $233,249 of which 52% went for taxes. Although this increase was called "interim" by the PUC, no review has been scheduled.

Surcharge Case . . .

. . . dismissed by Oregon court for lack of jurisdiction may set pattern for class suits

Dismissal for lack of jurisdicton by one Oregon Circuit Court may forecast the pattern for class suits brought against the three Oregon private utilities by customers complaining last winter's billing surcharges were improperly levied.

Lane County Circuit Judge G. F. Skipworth's dismissal of the suit against Mountain States Power Co declared the court lacked jurisdicton, as had been argued by MSP attorneys who also contended the plaintiffs had recourse to remedies provided by the code under which Oregon's Public Utilities Commission authorized the surcharges to recoup portions of abnormal steam generation costs last winter.

Appeal Doubtful . . . Harold K. McPherson and other Lane County customers of MSP had asked return of $580,000 collected from December through May and an order restraining the company from levying future surcharges. Whether the dismissal will be appealed is uncertain. Plaintiffs' attorneys said lack of funds may preclude this move.

Similar suits were filed against Portland General Electric and Pacific Power & Light companies in July in Multnomah, Portland County, but litigation there is slower. In a demurrer suit of four plaintiffs, PGE challenged sufficiency of the complaint on grounds:

1. Surcharges were collected under lawful tariff or emergency PUC order.
2. PUC law provides relief procedure and the suit is thereby improper.
3. The surcharge was before PUC, thereby abating the suit. PUC has since exonerated the companies by upholding legality of the surcharges after prolonged public hearing.

SEC to Slash Red Tape by 'Dovetailing' Reports

The Securities and Exchange Commission is trying to cut some of the red tape involved in complying with SEC reporting requirements. The basic idea is to eliminate from one reporting form information that already has been answered in another.

Criticisms of the past prompted SEC that a dovetailing of proxy statements, Federal Power Commission reports, and stockholder reports with regular SEC annual and monthly reports could avoid some of this repetition.

But so far as utility companies are concerned, the revisions may not materially affect reporting requirements. Very few in the past three or four years have taken advantage of the method of substituting FPC reports for SEC annual reports; and SEC still requires that any financial statements must be certified and contain profit and loss statements.

SEC's revision is aimed primarily at those companies which file proxy statements (1,537 out of 2,900 reporting). Comprehensive proxy statements and annual stockholder reports which contain certified financial information will now be accepted by SEC in lieu of practically all information formerly required in its reporting forms.

Gas Turbine Power Car

(*Continued from page* 109)

Oil Breaker Saves Space . . . Alternator switching is provided by the use of a 500-Mva main circuit breaker. The capacity of the breaker was determined by the possibility that the unit may be tied in to large power systems in the course of its service. An oil breaker is used because of space limitations. Such a breaker also has inherent resistance to vibration and shock. Disconnects are provided to isolate switchgear cubicles and instrument transformers.

Power cabling within the car, including main and field cables, is bronze armored cable supported from car members in such a way as to withstand the severe vibration of railroad service.

For starting the main engines and supplying auxiliary power, a six cylinder, 2-cycle diesel engine will be installed to drive a 4-pole alternator rated at 60 kw through a shaft extension from what is normally its fan end. The disconnect clutch may be disengaged automatically, the arrangement permitting development of auxiliary power when the main turbine is not in service. A torque converter with a minimum change in auxiliary engine speed will allow the turbine to be started without interruption of the auxiliary power service.

All Equipment for Safe Operation . . . Auxiliary equipment includes a main fuel supply including a 500-gal day tank, a transfer pump capable of drawing fuel from nearby tanks, and an auxiliary diesel fuel system which also contains a 500-gal tank. The lubrication system is conventional, bearing oil being normally supplied by a pump driven from the main turbine shaft. A station battery and battery charger make up a station dc system for circuit breaker control and emergency operation of some auxiliaries.

Controls and major operating and recording instruments are centralized at a panel in a control room near the right-hand end of the car. Space permits only the minimum equipment on the control panel for assuring safe operation, but this equipment includes an annunciator for providing visible and audible signals of irregular conditions.

Power Insurance!

Use and distribution of high voltages for factory power has proved itself in many ways. These voltages demand proper supports for busses and leads.

You'll find the exact mounting for any bar, tube, wire or cable conductor in Three E's complete line. Outdoor types to 69 kilovolts. Indoor types to 23 kilovolts.

Ask for Bulletin 226 for indoor supports.

Ask for Bulletin 271 for outdoor supports.

ELECTRICAL ENGINEERS EQUIPMENT CO., MELROSE PARK, ILLINOIS

PAGE FENCE—Since 1883

• AMERICA'S FIRST WIRE FENCE •

• Page Chain Link Fence, pioneered by Page and made only by Page, is quality controlled from raw metal to erected fence. Whether you choose heavily-galvanized Copper Bearing Steel, or long-lasting Stainless Steel, or corrosion-resisting Aluminum, you'll have a rugged fence on sturdy metal posts deep-set in concrete. Choose any one of 8 basic styles, varied by heights, types of gates, posts, top rails and barbed wire strands for extra protection. And to be sure of reliable workmanship your fence will be expertly erected by a specially trained firm. For helpful Page data and name of member nearest you...

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

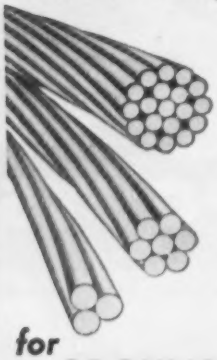
PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

an ACCO product

Stainless Steel STRAND

PAGE

will make it again



for

GROUND
GUY
MESSENGER
CATENARY

Higher—

Corrosion resistance
Tensile strength
Elastic limit
Resistance to abrasion
Strength-to-weight ratio

Lower—

Cost per year during use

Present restrictions prohibit our furnishing PAGE *Stainless Steel Strand today, but it will pay you to consider it for the future.*

PAGE Strand

ACCO

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

A1 Connector Tests

(*Continued from page* 107)

electrical load with its periodic fluctuations from low to high values. It is especially important or evaluate the effect of load cycling when a connector is to be used with dissimilar metals because different rates of expansion and contraction may cause serious trouble.

When an aluminum connector is used to join copper and aluminum conductors, the temperature resulting from current flow tends to expand the aluminum more than the copper. Aluminum has an expansion coefficient which is about 1 1/3 times that of copper so current flow tends to relieve contact pressure.

A small reduction in contact pressure may be desirable since metals tend to creep at higher temperatures. However, a properly designed aluminum connector runs appreciably cooler than the copper conductor within it. Therefore the lower temperature of the aluminum connector partially compensates for its greater expansion coefficient.

Proper design of an aluminum connector must evaluate and balance all of these factors. To minimize creep, particularly of the aluminum conductor, the right combination of contact area and contact pressure must be assured. Similarly, mechanical properties of the connector body and clamping hardware must provide sufficient resilience to permit expansion yet follow up relaxation and creep of the conductors.

Final Checkup . . . To determine the adequacy of aluminum connector designs, the heat cycling test is important. In such a setup, current is passed through a number of connectors in series until they reach a stable temperature. Current is then shut off until the connectors and conductors reach room temperature. The connectors are subjected to a number of such cycles needed to assure joint stability.

For most cases an overload current is selected to produce a conductor temperature of 100 C, a condition well in excess of that expected in normal service. Occasionally, connector designs are subjected to conductor temperatures of 125 and even 200 C when greater reliability is desired or when higher service temperatures may be encountered.

Experience has shown that a joint is stable if resistance and temperature remain virtually constant during 50 heat cycles. The laboratory arrangement for such a test is shown on page 105 where two aluminum couplers are connected in series on 1¼-in. copper tubing.

Heat cycle tests have been applied to a great variety of aluminum connectors on joints between aluminum and copper and even between copper and copper conductors. Typical results for such tests are shown in a chart. The top curve is for a clamp-type connector joining copper tubing end to end, using eight ½-in. aluminum alloy bolts. Middle and bottom curces are for the same type connector applied to 4/0 all-aluminum cable and 2/0 copper cable, using two ½-in. aluminum alloy bolts.

The connectors covered by the charted were unplated and used no bushings in the grooves. Penetrating connector compound was applied to the contact surfaces. To avoid corrosion at the contact surfaces, the design of the contact grooves must permit the compound to make an effective seal against penetration of the corrosive media. The compression connector is most effective in this respect since it completely surrounds the conductor.

To be effective, contact surfaces of clamp-type connectors must be relatively large, and the exposed portion of the conductor at the edges of the contact grooves must be a minimum. For this reason, a well-designed aluminum connector can accomodate a limited range of conductor sizes as a wide range demands a shallow groove with large openings exposed to corrosion.

Severity of load cycle, nature of environment and degree of reliability required are factors of great influence in aluminum connector design. For example, heavy-duty, clamp-type power connectors with many large aluminum alloy bolts have been developed for very severe duty and maximum reliability. In contrast, inexpensive single-bolt clamps are quite adequate for light-duty service. Furthermore, for greater economy, galvanized steel bolts may be used in mildly corrosive environments under certain conditions. Such cases must have a design that provides a connector-bolt combination of adequate resilience to allow for different expension coefficients.

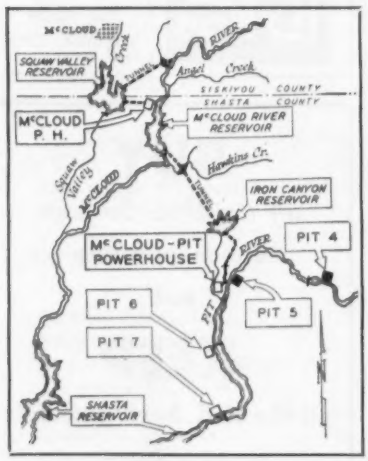
PG&E Project

California utility files application for hydro development on the McCloud River

Pacific Gas & Electric Co recently announced plans to harness the McCloud River and Squaw Valley Creek for hydroelectric generation in an $89-million McCloud-Pit River development 40 miles northeast of Redding, Calif. (EW, Feb. 15, p 5).

The utility has applied to the Federal Power Commission for a license for the project, which would involve two-step construction of eight dams, five tunnels totalling 17½ miles in length, and two powerhouses with a capacity of 232,000 kw.

First Stage . . . In the first stage, the McCloud diversion dam, a radial-gated, concrete gravity dam 225 ft high, will be built upstream from the junction of Lizzard Creek with the McCloud River, forming a 35,300



PROJECTS proposed for McCloud River

acre ft capacity reservoir. Water will be carried to Iron Canyon reservoir, formed by a 175 ft high earth fill dam, and from there to the turbines of the McCloud-Pit powerhouse. The powerhouse will have an initial capacity of 154,000 kw, but during the second stage it will be possible to raise capacity to 200,000.

Second Phase . . . In the second phase, two concrete gravity dams 50 and 57 ft high will be built upstream from the junction of Elk Creek and the McCloud River. The first, the Upper

SLASH OPERATING COSTS...

with Tel-E-Lect POLE LINE EQUIPMENT

For installation on your present truck—or on new equipment

A **POLE HOLE DIGGER** . . . Uses your regular derrick and crew. Attaches by a single bolt to power take-off shaft. Adjustable for clean holes up to 8 feet deep. Interchangeable augers 8 to 20 inches diameter.

B **DERRICKS** . . . Both "A" frame and "T" type for front or rear mounting on all makes of trucks.

C **UTILITY CABINETS AND MATERIAL RACKS** . . . Bolts onto any flat bed truck. Gives needed facilities for pole line work at a fraction of the cost of a utility body.

D **WINCH DRIVE BOX** . . . Gives instant forward and reverse action to your winch. Permits operator to give all his attention to the winch job and speeds up work. *Easy to operate:* Simply engage power take-off just once. No further shifting to PTO or use of truck clutch required. Just move a single cab lever forward or backward to lower or raise the winch line. Available for single or double drum winches.

For literature or demonstration, write to

TEL-E-LECT PRODUCTS, INC.

10,003 MINNETONKA BLVD. • MINNEAPOLIS 16, MINN.

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

McGraw-Hill Publishing Company, Room 2710, 330 West 42nd St., New York 36, N. Y.

MAGNETIC-AMPLIFIER CIRCUITS

Just Published!

This practical treatment of fundamental principles, characteristics, and applications logically develops the various kinds of basic and more complex magnetic amplifier circuit arrangements without extended mathematical considerations. Descriptive and graphical methods are used to give qualitative and quantitative interpretation of essential facts. Material is systematically classified according to circuit functions so you can compare and select solutions best suited to your special problem. **By William A. Geyger, U. S. Naval Ord. Lab. 277 pp., 135 illus., $6.00**

SILICONES and THEIR USES

Just Published!

This engineering-slanted manual provides a correlated source of the available information on properties, preparation, and applications of silicones—treated as non-technically as possible. It covers all the commercially available silicone products . . . lists industries and known uses they make of silicones, plus cost considerations . . . outlines history of silicone development, its possible uses in medicine and pharmacy, and the elementary chemistry of preparation of silicones from raw material to finished product. **By Rob Roy McGregor, Administrative Fellow, Mellon Inst. 238 pp., 29 illus., 31 tables, $6.00**

ENGINEERING VALUATION and DEPRECIATION

Gives in detail effective systematic appraisal procedures and techniques to follow in finding the value of industrial, commercial, utility, and natural-resource property. Explains various appraising tools . . . where to get data . . . how to use property and other accounting records . . . how to take inventory . . . how to get and analyze cost data, price, and construction cost. Gives a special view of depreciation as it applies to appraising, and help for appraising limited-life properties. **By Anson Marston, Robley Winfrey, and Jean C. Hempstead, all of Iowa State College. 2nd Ed., 486 pages, 31 illustrations, 74 tables, $6.00**

BUSINESS, LEGAL, and ETHICAL PHASES of ENGINEERING

Just Published—2nd Edition

Covers business theory and practices an engineer must know to soundly relate business and technical matters, to round out his specialized background, and to handle managerial posts and problems. Explains business organization, financial reports, contracts, sales and sales agreements, patents, insurance, codes of professional conduct, etc. Up-to-date Second Edition enlarged to help you in any field of engineering. **By Donald T. Canfield and J. H. Bowman, Profs. of Elec. Engr., Purdue Univ. 2nd Ed. 365 pp., 12 illus., $6.00**

READ THESE BOOKS 10 DAYS FREE

McGraw-Hill Book Co., 330 W. 42 St., NYC 36
Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus a few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

- ☐ Geyger—**Magnetic-Amplifier Circuits**—$6.00
- ☐ McGregor—**Silicones & Their Uses**—$6.00
- ☐ Marston, Winfrey, & Hempstead—**Eng. Valuation & Depreciation**—$6.00
- ☐ Canfield & Bowman—**Bus., Legal & Ethical Phases of Eng.**—$6.00

(Print)
Name .....
Address .....
City ..... Zone.... State.....
Company .....
Position W-2 22

This offer applies to U. S. only

McCloud Dam, will permit the river to flow through a tunnel into the reservoir of the Elk Creek Dam. From there it will flow into Squaw Valley reservoir, created by a 160 ft high earthfill dam. From Squaw Valley reservoir the water will be carried to the single turbine generator of the 32,000-kw McCloud powerhouse. A second penstock will be built to serve a third generating unit installed in the McCloud-Pit powerhouse.

The project also will utilize the McCloud River and Squaw Valley Creek in the operation of two other proposed powerhouses, Pit 6 and 7.

The company's license application says the first stage of the McCloud Pit development will be completed within four years after construction begins, and within two years of completion of either the Pit 6 or Pit 7 projects. The second stage will be started when economic conditions warrant.

Yellowtail Dam Authorized Interior's Solicitor Rules

Interior Department Solicitor Clarence A. Davis recently ruled that the 200,000-kw Yellowtail hydroelectric project in southeastern Montana is fully authorized under existing legislation (EW, Feb. 15, p 5).

An advisory opinion prepared by Davis holds that no further action is required by Congress for initiation of the Yellowtail project except the voting of necessary funds. A previous departmental opinion had held that a Congressional act of 1946 prohibited construction of the dam because some of the reservoir area would lie within the boundaries of the Crow Indian reservation.

The Davis study indicates that the 1946 act was directed at proposed extension of an existing irrigation system on the Crow reservation and had no reference to the Yellowtail project. That act prohibited "further construction work on the Crow Indian reservation without the consent of the Crow tribe and the irrigation districts affected."

Interior Department has not yet scheduled a start on the Montana project and no funds have been requested for fiscal 1955 for the project. But the recent opinion does indicate the department is interested and may possibly ask for funds to begin the work in fiscal 1956.

Save work with a HYKON CABLE REELIFT

Handles 2000 lb. reels

•

A QUICK and easy, practical lift for heavy cable reels. Eliminates problem of broken reels. No jacks, no tugging or rolling. Reelift has slip fittings on axle to permit simple loading and adjustment for any size reels. Two models: RL25 for reels 25 x 36" diam.; RL31 for reels 31 x 42" diam. Hundreds in use; rugged welded frame. Write for new Catalog.

HyKon MANUFACTURING CO.

Box 923H, Alliance, Ohio

BUY

all the U. S. Savings Bonds you can

and

KEEP

all the U. S. Savings Bonds you buy

THE STATES COMPANY

METER AND TRANSFORMER TESTING EQUIPMENT

•

TERMINAL BLOCKS

NEW PARK AVENUE

HARTFORD CONN.

Advertising In This Issue

Air Preheater Corp. 49
Aircraft-Marine Products, Inc. 34
Allis-Chalmers Mfg. Co. ....2nd Cover
12, 19, 35, 36, 37, 38, 150, 151
Aluminum Co. of America. 26, 27
American Blower Corp. 62, 63
American Telephone & Telegraph Co. 59
Anaconda Wire & Cable Co. ...52, 53
Anderson Brass Works, Inc. 175

Bethlehem Steel Co. 82
Blackburn Corp., Jasper 18
Brown Boveri Corp. 195
Burndy Engineering Co., Inc. 58

C-O-Two Fire Equipment Co. 74
Cable Spinning Equipment Co. 196
Chase Brass & Copper Co., Inc. 50
Chase-Shawmut Co. 139
Chevrolet Div. General Motors 41
Cole Electric Co. 208
Combustion Engineering, Inc. 142, 143
Cope, Inc., T. J. 16
Copperweld Steel Co. 57
Cornell-Dubilier Electric Corp. 40
Crescent Tool Co. 42

Delco-Remy Div. General Motors Corp. 28, 29
Diamond Power Specialty Corp. 176
Directory of Engineers. 204, 205
Dow Chemical Co., The 184
Driver-Harris Co. 171

Eastern Specialty Co. 172
Ebasco Services, Inc. 193
Electrical Engineers Equip. Co. 199
Electroline Company 5
Elliott Co. 14, 15
Engineers, Directory of. 204, 205
Erico Products, Inc. 67

Fargo Mfg. Co. 177
Federal Electric Products Co. 3rd Cover
Fisher-Pierce Co., Inc., The. 180
Four Wheel Drive Auto Co. 75

G&W Electric Specialty Co., Inc. 61
Gai-Tronics Corp. 167
General Cable Corp. 39
General Electric Co.
Apparatus Dept. 24, 25, 32, 33
120, 121, 123, 124, 125, 127
128, 129
Construction Materials Dept. 60
Gould-National Batteries, Inc. 83

Hazard Insulated Wire Works..4, 64
Hilliard Corp., The 192
Hi-Voltage Equipment Co. 22, 23
Honan-Crane Corp. 144
Hotpoint, Inc. 48
Hubbard & Co. 169
Hykon Mfg. Co. 202

Indiana Steel & Wire Co. 190
I-T-E Circuit Breaker Co. 132, 133
I-T-E Circuit Breaker Co. R & I E Equipment Div. 17
Irvington Varnish & Insulator Div., Minnesota Mining & Mfg. Co. 51

Johns-Manville 176
Joslyn Mfg. & Supply Co. 149

KPF Electric Co. 145
Kaiser Engineers Div. Henry J. Kaiser Co. 154
Kearney Corp., James R. 80, 81
Kerite Co., The 86
Kidde & Co., Inc., Walter 56
Kimble Glass Co. 66
Klein & Sons, Mathias 170
Koppers Co., Inc. 197
Kuhlman Electric Co. ....4th Cover

Lapp Insulator Co., Inc. 77
Laughlin Co., Thomas 140
Leeds & Northrup Co., The 187
Line Material Co. ..43, 44, 45, 46, 47

Mallory & Co., Inc., P. R. 10
McGraw-Hill Book Co. 202
Minneapolis-Honeywell Regulator Co., Industrial Div. 84, 85
Minnesota Mining & Mfg. Co. 186
Moloney Electric Co. 78, 79
Monsanto Chemical Co. 141

O.Z. Electrical Mfg. Co., Inc. 65
Ohio Brass Co. 135, 136, 137, 138
Okonite Co., The 4, 64

Pacific Electric Mfg. Corp. 71
Page Fence Association 199
Page Steel & Wire Div. American Chain & Cable 200
Palnut Co., The 190
Pennsylvania Transformer Co. 11
Philadelphia Gear Works, Inc. 181
Philco Corp., Industrial Div. 9
Porcelain Products, Inc. 69
Preformed Line Products Co. .30, 31
Pritchard & Co., J. F. 70

Radio Corp. of America, Engineering Products Dept. 13
Reliable Electric Co. 153
Reel-O-Matic Corp. 189
Revere Copper & Brass, Inc. 131
Riley Stoker Corp. 20, 21
Roebling's Sons Corp., John A. 55

S&C Electric Co. 6, 7
Sangamo Electric Co. 8
Searchlight Section 206, 207
Simplex Wire & Cable Co. 147
Snap-On Tools Corp. 174
Sprague Electric Co. 198
Standard Transformer Co. 178, 179
States Co., The 202
Stone & Webster Engineering Corp. 183
Sylvania Electric Products, Inc. 185

Tel-E-Lect Products, Inc. 201

United States Rubber Co. 68
Utilities Line Construction Co., Inc. 76

Victor Insulators, Inc. 173

Wagner Electric Corp. 72, 73
Western Precipitation Corp. 191
Westinghouse Electric Corp. .155, 156
157, 158, 159, 160, 161, 162
163, 164, 165, 166
Westinghouse Electric Corp. Lamp Div. 54

■

PROFESSIONAL SERVICES 204, 205

■

SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 205, 206
Selling Opportunities Offered..... 206
Positions Wanted 206
Employment Services 206

EQUIPMENT
(Used or Surplus New)
For Sale 206, 207

PROFESSIONAL SERVICES

Consulting Accounting Valuations | **Management Appraisals Construction** | **Designing Testing Financing** | **Inspections Cost Analysis Investigations**

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

FORD, BACON & DAVIS

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

N. A. LOUGEE & COMPANY

Engineers and Consultants

REPORTS — APPRAISALS
DEPRECIATION STUDIES — RATE CASES
BUSINESS AND ECONOMIC STUDIES

120 Broadway New York

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway Kansas City 2, Missouri

GILBERT ASSOCIATES, Inc.

Engineers • Consultants • Constructors
Reading, Pa.

Engineering and Design • Construction Supervision
Industrial • Sanitary • Safety
Chemical Laboratory Services
Business and Economic Research
Industrial Relations • Purchasing

New York Philadelphia Washington
Rome Manila Medellin

LUCAS & LUICK

Engineers

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

THEODORE D. BROSS & COMPANY

Steel Tower & Wood
Transmission Lines

Distribution & Maintenance

175 Enfield St. Hartford, Conn.

HARZA ENGINEERING CO.

Consulting Engineers

E. MONTFORD FUCIK CALVIN V. DAVIS
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street Chicago 6

LUTZ & MAY

Consulting Engineers

STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS—ELECTRIC SYSTEMS
REPORTS—DESIGN—APPRAISALS

1009 Baltimore Kansas City 6, Mo.

DAY & ZIMMERMAN, INC.

Engineers

Design - Construction - Management
Investigations and Reports

New York Philadelphia Chicago

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

1384 Holly Avenue, Columbus, Ohio

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

Doble Engineering Company

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr. Chicago, Ill.

JACKSON & MORELAND

Engineers and Consultants

Utilities and Industrials
Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston New York

MINER and MINER

Consulting Engineers
Incorporated

Greeley Colorado

Ebasco Services Incorporated

Engineers - Constructors - Business Consultants

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York
Chicago • Washington, D. C.

THE KULJIAN CORPORATION

Engineers - Constructors - Consultants

Power Plant Specialists

Utility - Industrial - Chemical

1200 N. Broad St., Philadelphia 21, Pa.

ARTHUR L. MULLERGREN

Engineering - Management
Public Utilities—Natural Gas

Kansas City, Mo.

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

LARAMORE and DOUGLASS, INC.

Consulting Engineers

Power Plants
Transmission Distribution
Design — Reports — Appraisals — Rates

79 East Adams Street
Chicago 3, Illinois

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing . .
Specialists in Financing
Accounting and Other Operations

231 So. La Salle St. Chicago 4

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Design—Surveys—Appraisals
Construction & Maintenance
Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. Binghamton, N. Y.

Peter F. Loftus Corporation

Engineering and Architectural Consultants and Designers

First National Bank Bldg.,
Pittsburgh 22, Pennsylvania
Cable Address—"LOFTUS Pittsburgh"

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES

THE ONE-STEP METHOD
(exclusive with R&S)

100 Sixth Ave. WOrth 6-2700 New York 13, N. Y.

PROFESSIONAL SERVICES

REIS & CHANDLER, INC.
ADVISORS TO UTILITIES
Financing—Rate of Return
30 Vesey Street, New York 7, N. Y.

SANDERSON & PORTER
Engineers and Constructors
New York • Chicago • San Francisco

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
Chicago, Ill.

F. W. SCHEIDENHELM
Consulting Engineer
Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
50 Church Street, New York 7, N. Y.

F. A. TUCKER, INC.
Contractors—Engineers
specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams
Main Office—88½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance
Transmission - Distribution
Electric and Telephone Lines
Consultants
501 York Road, Jenkintown, Pa.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals
80 Broad Street, New York 4

READERS MAY CONTACT
the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

BOOK REVIEWS

Measurement

Measurement Techniques in Mechanical Engineering. **By R. J. Sweeney. Published by John Wiley & Sons, Inc, New York 16, New York. 317 pages, illustrated. Price $5.50.**

Information about the measurement techniques used to test the performance of power equipment is the aim of this book. The scope includes engines, pumps, compressors, and combustion and heat-transfer apparatus. Quantities measured include length, area, time, speed, force, pressure, and fluid flow rates. Coverage extends to electrical and chemical methods where these are commonly used.

Instruments are discussed for their primary functions of measurement and indication, and as signal devices for automatic control. Methods for calibration are presented, and analysis of the possible magnitude of error.

The book was planned for the twofold purpose of use as a text and reference for engineering colleges and to guide practicing engineers in the selection and use of instruments. Familiarity with elementary physics, thermodynamics and calculus is required. Utility power station engineers and test personnel would find it helpful in establishing their test procedures, although their requirements frequently exceed the elementary cases presented.

Electron Circuitry

Circuit Theory of Electron Devices. **By E. Milton Boone. Published by John Wiley & Sons, Inc., New York 16, N. Y. 489 pages, illustrated. Price $8.50.**

Most electronic devices achieve their functions because of the circuitry which they incorporate. And so this book is designed to teach the theory of electronic circuits. Vacuum tubes and transistors are treated as four-terminal networks with properties which can be measured at the terminals.

The reader is assumed to have knowledge of mathematics through differential and integral calculus, elementary physics, and general circuit theory. More advanced background knowledge has been incorporated into the book as required for development of the subject.

The book was developed from 10 years experience for use as a text by upper class engineering students. It appears to be most suitable for that purpose, but also useful for study by older graduate engineers who seek training in electronics.

Radiotron Handbook

Radiotron Designer's Handbook. **4th Edition. Edited by F. Langford-Smith. Distributed by Radio Corp of America, Harrison, N. J. 1,522 pages, illustrated. Price $7.00.**

The title fails to indicate the true scope of this book. Far from devoting its pages to electron tube design, it presents their application in many types of circuits. This "4th edition" is a complete new book resembling earlier editions only in its clear and comprehensive presentation.

The editor's objective was a reference book for all who design and apply radio receivers or audio amplifiers. In this he has succeeded admirably. Copious illustrations and tabulations contribute to his presentation. And coverage of the basic fields is improved by the complete omission of radio transmission, TV, radar, testing equipment, and industrial electronics.

A 51-page index assures quick reference. Each chapter is augmented by an extensive bibliography of related literature from several countries.

World-wide sales of the previous edition exceeding 280,000 copies attest to the acceptance of Langford-Smith's Handbook. It is a valuable guide to all who work or play in the electronic field. In electric utilities this book should be available to all personnel concerned with mobile radio, carrier, microwave, radio and TV interference, and electronic control equipment.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT — BUSINESS OPPORTUNITIES
EQUIPMENT — USED OR RESALE

UNDISPLAYED RATE

$1.20 a line, minimum 3 lines.

To figure advance payment count 5 average words as a line.

Employment Wanted undisplayed advertising rate is one-half of above rate, payable in advance.

Box Numbers—Care of publication count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.

DISPLAYED RATE

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $11.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns — 30 inches—to a page.

ELECTRICAL ENGINEERS

Opportunities for young engineering graduates with interest in the electric power field.

Our work includes systems planning; plant and substation engineering; transmission and distribution engineering. We also have openings for men interested in power sales.

These positions offer excellent possibilities for advancement in the growing electric utility business.

Write direct giving age, education, experience, personal particulars and salary desired.

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY
75 Public Square Cleveland 1, Ohio

ELECTRICAL ENGINEERS

SENIORS—Experienced public utility electrical design, transmission and distribution engineers required by an established consulting organization for work on continued program of plant expansion, transmission and distribution planning and betterment work for public utility operating companies located in eleven Latin American countries. Headquarters New York; possibly some travel. Preferred age range 30-45. Attractive salaries. Excellent opportunities for qualified men. Reply stating age, education, experience and personal particulars.

P-1018, Electrical World
330 W. 42 St., New York 36, N. Y.

ADDITIONAL SEARCHLIGHT ADVERTISING
on Pages 206 and 207

SALES MANAGER

Capacitors—Line Type

Only applicants thoroughly familiar with general requirements of utilities, and with broad experience, will be considered. Salary commensurate with ability, plus opportunity for additional substantial financial return, awaits applicant. Our personnel are aware of this request for additional manpower. Individual could now be Sales Manager, Assistant Sales Manager, or top-grade sales representative with executive ability looking for an opportunity to upgrade. Manufacturing facilities now located in the East.

SW-1713, Electrical World, 330 W. 42nd St., New York 36, N. Y.

ELECTRICAL ENGINEERS

JUNIORS—Graduate electrical engineers for station design, transmission and distribution work required by an established consulting organization for work on continued program of plant expansion, transmission and distribution planning and betterment work for public utility operating companies located in eleven Latin American countries. Headquarters New York—possibly some travel. Preferred age under 30. Experience 0-5 years. Salary commensurate with qualifications. Splendid opportunities for right men. Reply stating age, education, experience and personal particulars.

P-1019, Electrical World
330 W. 42 St., New York 36, N. Y.

ELECTRICAL ENGINEER ESTIMATOR

Public utility substations, transmission, distribution systems and electric installations in generating stations.

Experienced Estimator required with at least ten years experience in design, construction and cost estimates of public utility generating stations, substations, transmission and distribution systems, by organization servicing public utilities in eleven Latin American countries. State age, education, experience, personal particulars, and salary desired. Location New York—some travel; Spanish or Portuguese desirable but not necessary.

P-1283, Electrical World
330 W. 42 St., New York 36, N. Y.

PERSONNEL-INDUSTRIAL RELATIONS EMPLOYEE TRAINING

Public utility companies located Latin America requirement for positions of industrial relations engineers, and supervisors of employe training and personnel departments. Applicants should have at least 5 years experience in their particular specialty and general acquaintance with public utility operations. Knowledge of Spanish or Portuguese desirable but not required initially. Positions offer promising fields for applicants with individual initiative, having good background of practical experience in their particular field. Salary commensurate with position, experience and living costs. Reply stating age, education, experience and personal particulars.

P-1020, Electrical World
330 W. 42 St., New York 36, N. Y.

WANTED
YOUNG ELECTRICAL ENGINEER
FOR SYSTEM PLANNING AND RELAY WORK IN GENERAL OFFICE
CENTRAL ILLINOIS PUBLIC SERVICE CO.
SPRINGFIELD, ILLINOIS
ATT: ELECTRICAL ENGINEER

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ELECTRICAL ENGINEERS—Draftsmen: Experience required excellent opportunity for work with Eastern Engineering firm. Include experience and salary requirements in first letter. Gannett Fleming Corddry and Carpenter, Inc., Box 366, Harrisburg, Pennsylvania.

WORKING MANAGER for small municipally owned utility. Must have experience for electric, Diesel plant, water and telephone systems. Population: 2500. Salary open with apartment available. Reply giving qualifications in training, experience, personal particulars, references and expected salary. Write airmail. Cordova Public Utilities, Cordova, Alaska.

WANTED: ELECTRICAL Design Engineer with exceptional ability and successful experience in the design and testing of light duty electrically operated remote controlled oil filled and dry type outdoor switching devices from 120 volts to 15 KV. This is an exceptional opportunity for an engineer capable of producing simple and practical designs for low volume production. Advancement is assured and salary attractive. The position is permanent with an established small manufacturer in Indiana. Give experience, education, references, age, recent photo if available, and salary expected. P-1621, Electrical World.

EMPLOYMENT SERVICES

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SALARIED POSITIONS $5,000 to $35,000. We offer the original personal employment service (established 44 years.) Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo 3, N. Y.

POSITIONS WANTED

EXPERIENCED SWITCHBOARD Operator would like operating job in central or substation. PW-8267, Electrical World.

SALES ENGINEER young aggressive expr. Automotive electrical equipment, marine industries, engr. Degree, will travel. PW-1698, Electrical World.

ELECTRICAL ENGINEER with 16 years experience in elec. eng'g, including administration, design, and operation in field of power utilities, industrial power, lighting, and control systems. PW-1708, Electrical World.

STEAM POWER Plant; management of operation in U.S.A. or abroad; thoroughly experienced on coal, oil, and gas fuels, industrial and public utility plants, up to 2,000 pounds pressure, 600,000 KW. Good background on erection and starting new plants; some power line construction. PW-1730, Electrical World.

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE — **Two Rector St., New York 6, N. Y.**

PRESSURE VESSELS

13—10' ID dia. x 40' long x 2½" to 3" Shell. Heads 3½" to 3". WP 600 and 500 psi.
8—8' ID dia. x 40' x 2" to 2½" Shell. Head 2¼". WP 500 psi.
All used, excellent condition, code welded construction, manufactured by A. O. Smith. Must vacate soon from present location East Chicago, Ind. Priced low for prompt shipment. Prints, prices available upon request.

KINSLOW POWER & EQUIPMENT CO.
Box 5232 *Phone 5-5914* Tulsa, Okla.

We are offering all of the following equipment for immediate sale— $1,200.00 cash—f.o.b. storage in Anderson, Indiana.

1—60 HP Century motor—2200 volt, 3 phase, 60 cycle, complete with sliding base, speed 1160, serial #1U1407
1—40 HP Century motor—2200 volt, 3 phase, 60 cycle, complete with sliding base, speed 1735, serial #1U1390
2—Westinghouse oil immersed magnetic starters.
2—60KVA Condensers with switches. These capacitors are designed to maintain a minimum power factor of 98% for the primary service to the 60 HP and 40 HP motors.

WHITE FROST CO., INC.
525 West 8th Street Anderson, Indiana

TURBO GENERATOR
Available Immediately
7500 KW G. E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

FOR SALE
SUBMARINE CABLE
440' 3C #2/0 Shielded Conductors plus 3 #4 Bare Ground Wires, Simplex Anhydrex, #6 Galv. Wire Armor, Pulling Eye, on 72" Reel, New, Factory Test Data Available.
HECKLER ELECTRIC COMPANY INC.
44 Schenectady Ave. Brooklyn 13, N. Y. PR 4-3700

"SEARCHLIGHT"
IS
Opportunity Advertising

—to help you get what you want.

—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	333	Stand.	69000/34500—7200/12470 Y
3	200	Pitts.	66000—2360
3	1250	A. C.	44000/11500
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
4	4500	G. E.	3600—13300—2400
3	3333	G. E.	33000/11000—2400/7200
3	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	26400/13200—2400
4	1500	A. C.	25400/44000 Y—6900/13800
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	600	Stand.	13200—2300, 3 ph
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G. E.	13200—2400/4160 Y
3	250	Pitts.	7200—220/440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y —115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—Outdoor

1— 390 KVA G. E.-Step 541 amp. 4160 V. 3 ph.
3— 96 KVA G. E. 200/400 Amp. 2400 V. 1 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

4— 800 A. 132 KV West. G-222A-2500 MVA
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
2—4000 A. 15 KV G. E. FHKO-139-1000 MVA
2—2000 A. 15 KV G. E. FHKO-239-1500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & CO., INC.
52 Church Street New York 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Desc.
1	4000	G.E.	Condensing—425 lbs—750° F.T.T.—Surface Condenser 3/60/2300-4000 v with exciter
1—	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1—	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P. 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1—	13900	Whse.	25/60	13200 x 13200
1—	3750	G.E.	25/60	4150/2400 x 2400/4150
1—	3125	G.E.	25/60	4150/2400 x 2400/4150
2—	2500	G.E.	25/62½	2300 x 4160
1—	1250	G.E.	25/58.3	4400 x 2300
1—	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS
3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1-	3000 3U	G.E.	514	600	4000/13200
2—	2000	G.E.	450	250	2400
2—	2000	G.E.	514	600	6600/13200
1—	2000	G.E.	500	666 25 cy.	11000
2—	1750	G.E.	514	250	2400
1—	1500	C.W.	514	115	4000/13800
1—	1500	G.E.	720	600	13200
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4150
1—	750	Whse.	900	275	2300/4150
1—	600	Whse.	1200	125/250	2300
1—	600	Whse.	900	250	440
1—	600	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
1—1500	G.E.	HT	3	13200 x 2300
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

BELYEA COMPANY, INC.
OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1136	Fairbanks Morse	38D	1600	720	300	General Motors	8-268A	450	1200
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	8-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	8-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

ELECTRICAL **WIRE** AND **CABLE**

—YOUR BEST SOURCE—
- for every industrial and power application
- odd lengths—long and short —reasonably priced
- largest stock in Midwest
- varnished cambric — leaded — neoprene

Let us quote on requirements—send your inquiries

DELIVERY
QUICK . . . from stock
We'll also buy your Surplus

Branch Offices:
Houston—Yukon 5547
Los Angeles—DUnkirk 7-3265

UNIVERSAL Wire and Cable Co.
2900 N Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1606 52nd ST., NORTH BERGEN, N. J. N.Y.C. Tel. LOngacre 5-3221 N. J. Tel. UNion 3-

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranel
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM, 220V, 3/60.
2— 150 H.P., Al. Chal. 360 RPM. 440V. 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM. 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM. 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM. 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM. 4000V. Syn.
1— 150 KW G.E., 125/250V. 1200 RPM. 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM. 2300V. Syn.

SLIP RING MOTORS

2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM. 550V.
1— 250 H.P., West., CW. 600 RPM. 440V.
1— 200 H.P., West., CW. 900 RPM. 440V.
3— 150 H.P., Al. Ch. 1800 RPM. 2300V., 3PH. 60 Cy.

Large Stock of A.C. and D.C. Equipment

FOR SALE

BRAND NEW *Meters*

In original cartons
1500 pieces

WEST. TYPE CA — 15 amp. 120v. 2-wire 60 cycle
G. E. TYPE I-30A — 15 amp. 120v. 2-wire 60 cycle
Offered subject prior sale at a Substantial Savings

ATLANTIC ELECTRIC METER CORP.
214 E. 41 St. New York 17, N. Y. Vanderbilt 6-1958
LARGE BUYERS OF METERS

—TRANSFORMERS—

BOUGHT AND SOLD

We carry a large stock of rebuilt and guaranteed transformers, and invite your inquiries.

Custom-built transformers and coils manufactured to your specifications.

Expert Repair Service—all makes and sizes of transformers rewound, repaired and redesigned.

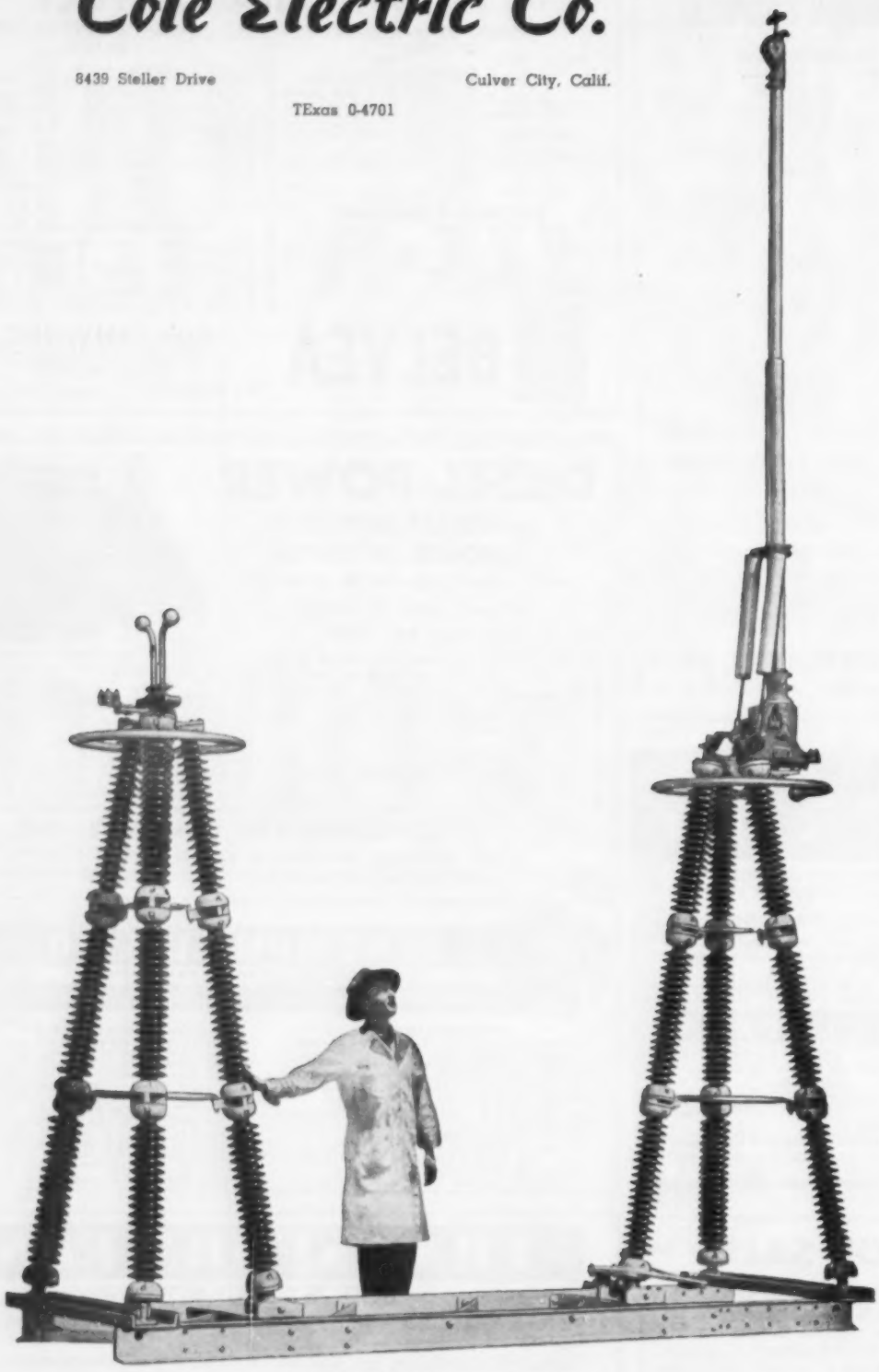
Ask for our price schedule

THE ELECTRIC SERVICE CO., INC.
5331 Hetzel St. Cincinnati 27, Ohio
40 Years' Dependable Service

Cole Electric Co.

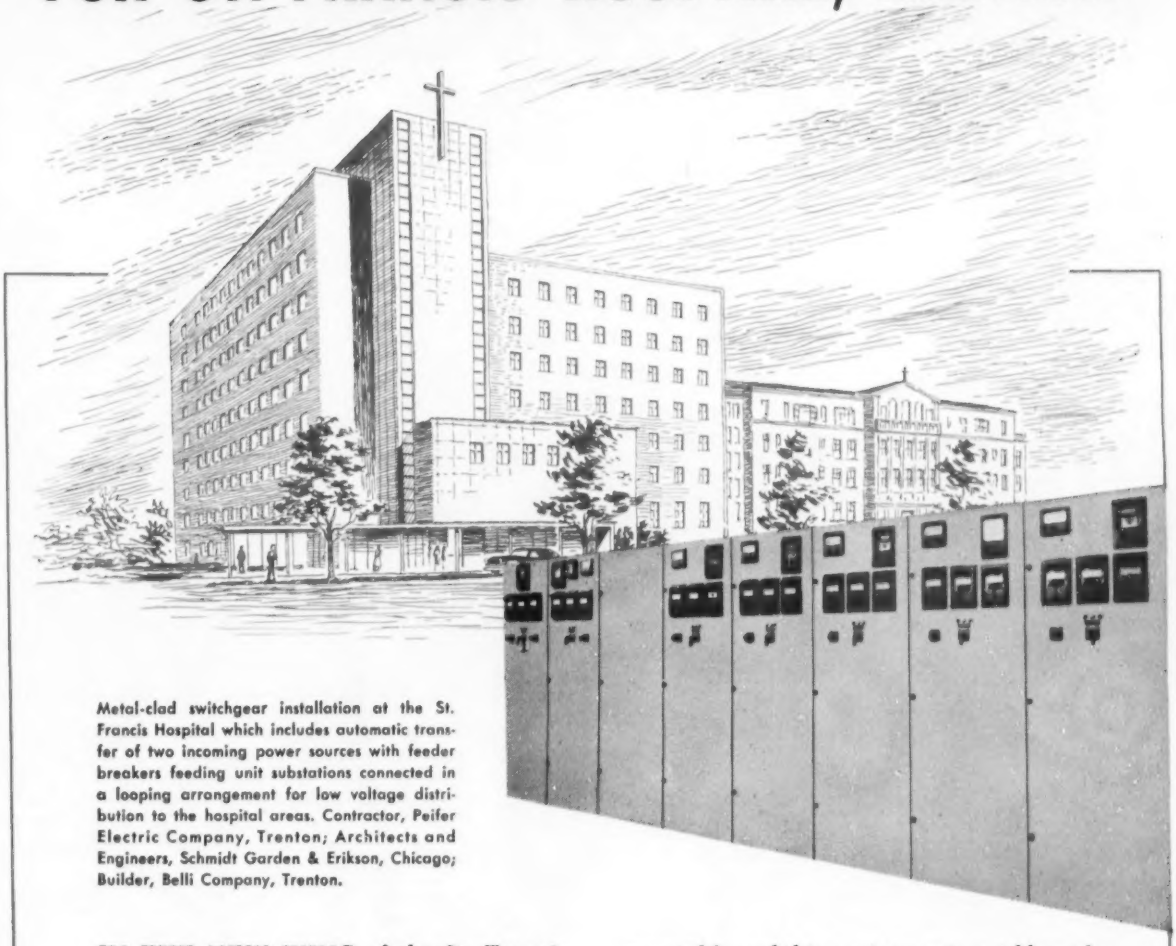
8439 Steller Drive Culver City, Calif.

TExas 0-4701



AIR BREAK DISCONNECTING SWITCH
230,000 Volts—1200 Amperes—Type MO-2
Vertical Break—Three Pole, Single Throw
SILVER TO SILVER CONTACTS
Group Operated
(One Pole Shown)

IT'S FEDERAL-PACIFIC SWITCHGEAR FOR ST. FRANCIS HOSPITAL, TRENTON



Metal-clad switchgear installation at the St. Francis Hospital which includes automatic transfer of two incoming power sources with feeder breakers feeding unit substations connected in a looping arrangement for low voltage distribution to the hospital areas. Contractor, Peifer Electric Company, Trenton; Architects and Engineers, Schmidt Garden & Erikson, Chicago; Builder, Belli Company, Trenton.

IN THE NEW WING of the St. Francis Hospital, Trenton, N. J., the entire electrical system is controlled by Federal-Pacific equipment. The installation includes a 5 K. V. metal-clad switchgear installation employing magnetic air break circuit breakers, unit substations, and necessary lighting and distribution panelboards.

Federal-Pacific electrical equipment for light and power is today's leading specification both for new construction and modernization programs. Most of this equipment is quickly and economically assembled from standard units to meet specific requirements. You can always look to it for lowest installation costs . . . and for engineering that assures top efficiency, easy maintenance, and ready adaptability for future changes or expansion.

When you have an electric distribution problem, Federal-Pacific will be glad to study it. Write Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

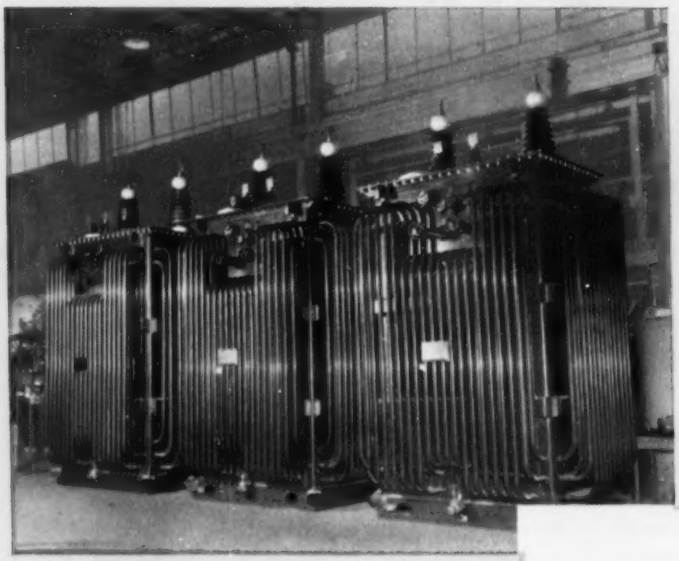
FEDERAL & PACIFIC

ELECTRIC PRODUCTS COMPANY — ELECTRIC MANUFACTURING CORP.

Federal products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

KUHLMAN—the first nationally known transformer manufacturer with a plant in the South . . . to serve the South!

Established in 1952 to manufacture transformers in the South — for the industrial needs of the South — Kuhlman's Southern Division at Crystal Springs, Mississippi, is located close to the center of the great Southern market. With offices and warehouses in principal cities throughout the South, Kuhlman is well situated to serve Southern utilities and industry.



This big, modern plant of Kuhlman Electric Company at Crystal Springs is completely equipped to build dependable transformers that will provide a steady source of power for Southern utility and industrial customers. From here, transformers can be shipped directly to any part of the South.

These three 2500-KVA, Single Phase, 69000-volt primary Kuhlman Power Transformers were built at Kuhlman's Southern factory. Kuhlman also builds Distribution, Dry Type, Subway, Saf-T-Kuhl, CSP and Series Street Lighting Transformers. For complete information, write today.

KUHLMAN

150

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN • Southern Division, CRYSTAL SPRINGS, MISSISSIPPI

EXPORT REPRESENTATIVE: INTERNATIONAL STANDARD ELECTRIC CORP., 15TH FLOOR, 50 CHURCH STREET, N. Y. 7, N. Y. CABLE ADDRESS: MICROPHONE, N. Y.

SIXTY YEARS OF PROGRESS IN THE ELECTRICAL INDUSTRY